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The

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THE UGANDA PROTECTORATE, RUWENZORI, AND THE SEMLIKI FOREST.*

By Sir HARRY JOHNSTON, G.C.M.G., K.C.B.

In compiling this paper for the Royal Geographical Society, I am anxious, as far as possible, to confine myself to original matter, to give nothing but my own views and experiences, and not to forget that a good deal of the ground I have actually crossed has been traversed by preceding travellers, many of whose accounts may still stand as authoritative, and in some measure final. In order to be systematic, I propose to take the Uganda Protectorate province by province, and give what original information I can about each province in its turn.

As one of the results done by the work of my Special Commission, I should mention that the Uganda Protectorate was definitely divided into provinces and districts for administrative purposes. A map illustrating these divisions was published by His Majesty's Government in illustration of my last Report on the Uganda Protectorate in July, 1901. The provinces are six in number: Eastern, Rudolf, Central, Nile, Kingdom of Uganda, and Western. Each province is divided into a number of districts, ordinarily three or four, but in the case of the Kingdom of Uganda, into twenty administrative divisions.

The Eastern Province stretches from the western boundary of the East Africa Protectorate—which is more or less the line of the Kikuyu-Laikipia Escarpment—on the east to the shores of the Victoria Nyanza, and the vicinity of Mount Elgon on the west. On the north it extends to that little-known salt lake or swamp Sugota and the vicinity of Lake Rudolf. The scenery and the climate of this province are extremely varied. On the extreme south, towards the German frontier,

* Read at the Royal Geographical Society, November 11, 1901. Map, p. 120.

down the depression of the Rift valley, it tends decidedly towards sterility, while at the same time the general level (except on the Mau highlands) decreases from the average 6000 feet of the central part of the province to about 3500. Likewise on the north the tendency is also to a decrease of level, and with this decreasing altitude to a diminution in the rainfall and consequent deficiency in vegetation. About Lake Naivasha that remarkable geographical feature known as the Rift valley—a winding depression of an average 40 miles in width, which is bordered on either side by more or less regular mountain cliffs, and can be traced imperfectly through East Africa from the vicinity of Lake Rukwa on the south to the Gulf of Aden on the north —is arched to its greatest altitude of 6300 feet. North-west and south-west the floor of the Rift valley diminishes in altitude. South of Lake Naivasha, as already stated, there is a marked decrease in the annual rainfall, and a tendency in the Rift valley towards a desert appearance. This is again the case north of Lake Baringo, and the country between Baringo and the north end of Rudolf offers, in many parts, a striking resemblance to the Sahara, not only in the deficiency of vegetation, but in the character of such plants as do survive, and to some extent also in the fauna, especially amongst birds and mammals.

The traveller from Mombasa, before reaching the frontier of Uganda, has passed through the country of Kikuyu, which is well forested and richly clothed with vegetation. As he descends into the Rift valley the Kikuyu vegetation decreases in luxuriance, and a very prominent feature is a particularly ugly form of dracœna (a kind of tree-aloe) with stiff sword-leaves of a sickly yellow-green. In the vicinity of Lake Naivasha there is short sweet grass, which is probably kept low by the browsing of innumerable antelopes and the herds of Masai cattle. Near Naivasha station the Kikuyu escarpment, descending in a series of terraces, terminates abruptly in a line of precipitous cliffs, on the edges of which huge boulders and monoliths are poised. The shores of Naivasha are in many places thickly belted with papyrus, which is growing at an altitude (over 6300 feet) and in a mean temperature not usually associated with this rush. On the western and northern sides of Naivasha there are belts of forest usually consisting of acacias. There is a great deal of water-weed in the lake, which at certain times of the year makes portions of its surface absolutely orange-brown. There are two large islands. The smaller of these two, which is near the eastern shore, is, by means of an intervening island, sufficiently closely connected with the shore to be within reach by swimming of various types of large game, while on the other hand the water to be traversed has served to cut off the island from visits by man, local and native man belonging to the Masai and kindred tribes being entirely unpossessed of canoes, and not much given to swimming. The result is that, until within recent years a

boat was placed by the British Administration on Naivasha, these islands had probably never been visited by man, and the antelopes and other game living on them were found to be extraordinarily tame. The boat in question was stove in by a hippopotamus, and has therefore become useless. One of my last directions given before I left Uganda was to the effect that this island near the eastern shore should be constituted a game reserve, a park in which the antelopes now inhabiting it might continue to dwell in safety. There are no crocodiles in Lake Naivasha, though there are hippopotamuses. It was formerly stated that there were no fish, but my assistant, Mr. Doggett, discovered small fishes there belonging to the types I have found in this chain of lakes in

ON THE NANDI PLATEAU.

the Rift valley. The water-birds are not quite so abundant as formerly, owing to the extent to which they have been shot at by Europeans; but during one of my visits to the lake I enjoyed a beautiful spectacle of rosy flamingoes in regiments of thousands lining the northern shores.

The amount of game to be seen about Naivasha is probably more abundant than formerly, owing to the measure of protection it has received, but I should say there was less variety in the species, certain animals having died out owing to the former persecution at the hands of sportsmen (natives as well as Europeans), and owing to the ravages of cattle-plagues. The most prominent animals seen in this part of the Rift valley at the present time are Grant's and Thomson's gazelles, Coke's and Jackson's hartebeests, water-buck, oribi, zebras, lions, leopards,

and hyænas. The Aard wolf of South Africa is also found in the vicinity of Lake Naivasha.

Man as a native is not very frequently met with in this part of the Rift valley, a good deal of the country being quite unpopulated. The Mau forests, which begin on the Mau escarpment to the west of Lake Naivasha, are, however, thinly inhabited, and their inhabitants consist for the most part of wandering Masai and Andorobo. Westwards of the densest Mau forests begin the settlements of the Sotik and Lumbwa. These people belong to the same race and speak the same language as the Nandi, and this Nandi group of people and languages extends as far north in their scattered distribution as the northernmost slopes of Mount Elgon, if indeed they are not found inhabiting other mountain ranges further north-west still in the direction of the Karamojo country. The westernmost portion of the Naivasha district at the present day is the coastland of Ugaya, along the Victoria Nyanza, and here the inhabitants seem for the most part to belong to the Nilotic Negro section in language, if not wholly in race; * but between these people of what used formerly to be called Southern Kavirondo and the mountain races of the Lumbwa and Sotik who belong to the Nandi group, there is a most interesting wedge of Bantu-speaking people, known by their Masai name of Kósova,† but calling themselves Bagizii. The credit of this interesting discovery is due, in the first place, to Mr. C. W. Hobley, the sub-commissioner for the Eastern Province who has done so much during the past six years to increase our knowledge of the geography and human races of East Africa. Mr. Hobley directed my attention to the fact that the Kósova people spoke a Bantu language, and, by inducing representatives of this tribe to visit me, enabled me to take down extensive vocabularies of their dialect, which turns out to be a most interesting and archaic form of Bantu, allied to the languages of Northern Kavirondo and of the western slopes of Mount Elgon.

In the Rift valley round about Naivasha, the dominant people are the Masai, though occasionally representatives of the Kikuyu tribe come down from the eastern heights for the purposes of trade, while that tribe of more or less nomad hunters, the Andorobo, range at will up and down the valley in pursuit of game. In language the A-kikuyu are of course purely Bantu, and their language, though it offers more archaic features, is most allied on the whole to the Kamba group of East Africa. I need say nothing about the A-kikuyu here, as the peculiar features of

* Since this was written, Mr. Hobley has made the interesting discovery that the inhabitants of the two large islands off the mouth of Kavirondo bay, and the inhabitants of the coast of the lake southwards to the German frontier, belong to tribes speaking Bantu languages. I have, however, myself met Nilotic-speaking natives from the Ugaya coast.

† Pronounce "Káwsŏvă."

that race have been admirably illustrated in a paper by Mr. Richard Crawshay, which will shortly be published in the *J urnal.* The Masai of the Naivasha district belong to the essentially cattle-keeping, semi-nomad division of that race, and were until quite recently one of the clans depending on the great chief who resided more or less in the neighbourhood of Nairobi. Quite recently, however, for political reasons, it has been thought advisable to make the Masai dwelling within the Eastern Province of the Uganda Protectorate independent of any political connection with those of the adjoining East Africa Protectorate or of German East Africa. The Masai of Naivasha differ very little in characteristics from those dwelling between Mounts Kilimanjaro and Kenia, who have been so often described by travellers from the time of Joseph Thomson onwards. The chief difference that I notice myself is in the shape of the spear, which is far longer and less broad than that used in the neighbourhood of Kilimanjaro. I agree in all that has been said by the best authorities on the subject of the Masai as regards their splendid physical appearance and their many amiable traits in character. They are emphatically a lordly race. It is doubtful whether they have ever been inherently unfriendly to Europeans, and most of the disasters which occurred in the early days of the opening up of East Africa were in the first place the fault of unscrupulous European traders, who certainly wronged the Masai before these people were provoked to reprisals. No sooner has British authority been established with emphasis, and I hope with justice, in these regions, than the Masai have —at any rate in the Uganda Protectorate—taken our side in any troubles we may have had with other native tribes. At the present moment the whole of the Masai of the Rift valley between German East Africa on the south and Lake Baringo on the north, have shown themselves ready, at a word from us, to enrol themselves as a contingent of irregulars, for the effectual chastisement either of the Nandi or of the Suk—two tribes whose aggressions on Europeans were remarkable in the history of East Africa, in that they were so little the result of anterior provocation and so much the direct outcome of a desire for robbery. Unfortunately, at the present moment, the Masai race is on the road towards extinction. It received a staggering blow from the severe cattle-plagues which have raged throughout East Africa at intervals from the beginning of the "eighties" to the present day. It is, of course, well known to most Fellows of the Royal Geographical Society that the Masai as a race are divided into two very different sections, the cattle-keeping, semi-nomad Masai proper, and the agricultural Masai, who are variously known as the Gwas 'Ngishu, Enjamusi (Njemps), who call themselves "Nyarusi," and Kwavi.* Whether the Masai were originally an agricultural people, a section of whom, by

* I cannot say I have ever heard a Masai-speaking person use the term "kwavi." It is a word of quite unknown origin introduced by Krapf.

means of its rapid conquests of East Africa, turned its thoughts entirely towards cattle-keeping and bothered no longer to till the ungrateful soil, or whether they started as a pastoral people of which a section only turned to agriculture after great misfortune, I cannot at the present time determine. At any rate, some sixty or seventy years ago, or even further back, one section of the Masai in the Baringo and Elgon districts seems to have taken definitely to agriculture and a life of settled towns, while the other and larger division depended solely for its subsistence on the milk and meat of its flocks of cattle, sheep, and goats, and only obtained such vegetable food (as was eaten by its old men and women) by trading intercourse with the neighbouring agricultural races of Bantu speech. The Masai cattle-keeping section turned on the Kwavi or agricultural section many years ago with fierce attacks which very nearly led to the extermination of the weaker agricultural communities. These, however, survived the struggle in scattered settlements, and are now on the road to increase and prosperity. On the other hand, the far larger section of the tribe which has depended hitherto solely on its flocks and herds for subsistence is in many districts badly off for food. The advent of the Uganda railway has had a strange influence also on the fate of this race. The Masai women, never at any time remarkable for strict virtue, were extraordinarily attracted by the Panjabi coolies from India, and flocked in numbers to the railway, where they became the mistresses of these stalwart, bearded men from Northern India. Not only did the men of their tribe appear to resent this defection of their women but slightly, but they themselves seem to have acquired an actual dislike for the getting of children, due in part, no doubt, to the uncertainty as to food, and in part, also, to their love of a restless, wandering life. They too have been much attracted by the railway and the work on the line, strangely as this last may seem to differ from their normal habits. Where they settle down at all, it is rather by marriage with Kikuyu women or women from the East Coast. From one cause and another, therefore, the Masai race is tending somewhat to disappearance, either by dying out or by fusion with other tribes. The last year or so, however, there has been a marked increase in prosperity amongst the Masai of Naivasha. The Uganda Protectorate has been strangely and happily free from cattle plagues of late years. There have been absolute law and order in affairs in the Naivasha district, at any rate for the last three years. The Masai have had a splendid market in the Uganda railway for the disposal of their extra live stock; their fighting men have received pay and encouragement from the British Administration, which have utilized their services in putting down local disturbances. I may also say we have been fortunate in the military and civil officers employed in these countries, and I am, therefore, in hopes that the Masai of the Naivasha region may increase and multiply and preserve their purity of race.

The Andorobo, of whom such frequent mention has been made from the time of Joseph Thomson onwards, appear to be one of two semi-nomad tribes who are to a great extent associated with the Masai. The other tribe in question is called the Engugunya, and of these I know nothing, as I have seen no representatives of them; but with regard to the Andorobo, I am now able to speak with some authority as to their characteristics and origin. Physically and linguistically the Andorobo are nothing but a branch of the Nandi stock. Their language only differs from the language spoken in Nandi or Kamasia to the same extent that Lowland Scotch differs from London English. Yet physically there is no fixed type amongst the Andorobo any more than there is

THE CRATER RIM OF ELGON FROM THE WEST.

amongst the Nandi. Perhaps, however, the Andorobo are composed of even more varied human types than the Nandi tribes. I can only define them somewhat clumsily as being a mixture of the Nandi with some pre-existing race of a very low type, possibly closely allied to the forest Pygmies of West Central Africa. But the Nandi type, again, is very mixed, consisting fundamentally of a stock like the Masai, which has mingled with some low Pygmy type, the Masai features, however, predominating. Then the Masai, again, are an ancient mingling of Nile Negro with Hamite, that is to say, some Negroid or non-Negro race like the modern Gala and Somali. Amongst the Andorobo you will see, if not in the same family, at any rate in the same cluster of people, hideous little black prognathous dwarfs side by side with handsome youths of almost European features. The Andorobo construct for themselves

small huts in the vicinity of their hunting-places. This little village of huts is sometimes surrounded by a thorn hedge. The huts in shape and size are strangely reminiscent of the Pygmies in the Congo forest. The Andorobo are semi-nomadic—that is to say, they establish temporary villages in places where game is abundant, and they may resort to these villages periodically according to the fluctuations of the game-supply. Formerly they were much kept in order by the Masai, and the Masai, for reasons of indifference, left wild animals alone and did not kill them for food. But since the Masai have been prevented from domineering over other peoples, the Andorobo have shown their ingratitude for this Pax Britannica by a reckless slaughter of all forms of game, from monkeys to elephants.

The water of Lake Naivasha is quite sweet, though it is sometimes so full of vegetable matter as to require careful filtering. The water of Lakes Nakuro, Elmentaita, and Hannington is nauseous and utterly undrinkable. The water of Lake Baringo is more or less undrinkable close to the shore, especially when the level of the lake is low. The natives therefore push out in their canoes some hundreds of yards into the open lake, and there obtain water which is fairly palatable. At the time I saw Lake Baringo there had been a rainy season of exceptional duration, and the waters of the lake, owing to the overflow of its feeding rivers, extended a considerable distance beyond where the southern shore is marked on the map. On the other hand, the swamps north of Lake Hannington were also full, and it seemed to me that I waded through water almost the whole way between the southern portion of Baringo and the north-east shore of Lake Hannington, into which, by the way, a river falls not marked on the map. So far as my eye alone can judge, I should think that at one time, and even at the present day in exceptional rainy seasons, the waters of the two lakes were united. Lake Hannington is one of the most beautiful sights which can be offered by the Uganda Protectorate. It lies at the base of tremendously high mountains, which tower above it so precipitously that their reflection seems to occupy the whole surface of the lake when seen from its western shore. Therefore the waters appear a very deep blue-green, and their surface is so still, and the mirror-like reflection so complete, that when coming upon the lake suddenly it is difficult to realize at first that you are looking down on a lake, and not on some awful chasm in the Earth's surface over which hundreds of thousands of flamingoes are floating ; for the only thing real about the lake when seen under these conditions are the flamingoes, the still waters being such an absolute mirror of the surrounding mountains. On Lake Hannington it is no exaggeration to say that there must be hundreds of thousands, if not close upon a million, flamingoes. They belong to the rosy species, which is slightly smaller than the Mediterranean flamingo, but exquisitely beautiful in plumage. These flamingoes nest

on a flat plain of mud about a mile broad to the north end of Lake Hannington, where their nests, in the form of little mounds of mud with feathers plastered on the top, appear like innumerable molehills. The birds, having hitherto been absolutely unmolested by man, are quite tame. On the north coast of the lake they extend for at least a mile in density from the muddy plain mentioned above right out into the waters of the lake. Seen from above, they look like a belt which on its outer side is grey-white, then becomes white in the middle, and possesses an inner ring of the most exquisite rose tint. The reason for this is that all the birds on the outer edge of the semicircle are the young in their immature plumage, those in the middle of the belt are full-grown birds that have not acquired the full beauty of the adult, while along the inner edge are old birds in the full beauty of a plumage which ranges from pale blush-pink to scarlet-crimson. Lake Hannington is known to the Masai as Mbatibat, and to the Kamasia tribe as Makaria. I might mention that the real Masai name for Naivasha is Naiposha. Baringo should be called Mbaringo; Nakuro and Elmentaita are approximately correct. Naiposha is a common Masai word for "lake," and is often applied to pieces of water like Baringo. Lake Sugota is a stretch of fairly open water, though no doubt it shrinks in dry seasons considerably, and a good deal of its space is given up to weeds. I have not seen it myself, but it has been sighted by military officers journeying with me from the heights of the Ribo hills.

The Kamasia people, whom I have already mentioned, are simply a northern branch of the Nandi, as are also the Elgeyo and Mutei. The Kamasia really call themselves Eltuken, Kamasia being a name given to them by the Masai. The Elgeyo escarpment is certainly one of the "sights" of the Uganda Protectorate—at any rate, as seen from its western aspect. You seem to look down a sheer 5000 feet in a straight drop on to a trench-like valley, the floor of which is covered by a small lake,* several lakelets, and a connecting river. North of this escarpment (the plateau between its western edge and the slopes of Mount Elgon being almost entirely uninhabited) the Suk people begin, and extend from the upper waters of the Turkwel river south-eastwards to the north end of Baringo. The Suk are intimately connected with the Turkana of western Rudolf, and also with the Karamojo people to the west of the river Turkwel. The differences between their languages are hardly greater than between Spanish and Italian, while between the Suk and Turkana there seems to be no difference in physique, appearance, manners, or customs. So far as community of language goes, there is a curious branch of this Suk-Turkana group to be found to the south-west of Mount Elgon in the Elgumi people. As regards linguistic affinities, the Suk-Turkana group of languages is almost exactly midway between Masai on the one

* Discovered by Mr. F. W. Isaac.

hand, and Nandi on the other, while all these groups offer distant but distinct affinities to the languages of the White Nile—Dinka, Shuluk, and Acholi.* The Bari and Latuka of the upper Nile are more closely related to the Masai. The Suk, like the Turkana, are a race of very tall stature, though it is very often easy to exaggerate their height in measuring merely by the eye and not by the tape. Still, in my anthropometric records I have recorded the measurements of several Suk of 6 feet 3 inches, who did not appear singular for their height amongst a number of tall comrades. The Suk, like many allied races to the north and north-west, wear their hair in extraordinary bags down the back. As this mode of wearing hair has been fully described by me in recently published numbers of the *Graphic*, I will not repeat the description here.

From the north-eastern buttresses of Mount Elgon, and the head-waters of the Weiwei river on the north, to the frontier of German East Africa on the south—a distance of about 240 miles—extends at altitudes ranging between 5000 and 10,000 feet (but ordinarily standing at an average height of 7000 feet), one of the most beautiful and healthful districts to be found anywhere in the Dark Continent. This belt of country, which has an average breadth of 45 miles, is a continuous plateau called in the south Mau, in the centre Nandi, and in the north Elgeyo and Gwas' Ngishu. In order not to be too diffuse in nomenclature, I shall henceforth style this lofty region the Nandi plateau, as it is mainly inhabited—so far as it has any human inhabitants at present—by races of the Nandi stock.

The scenery on the Nandi plateau reminds the homesick official and traveller over and over again of England, of Wales, of Scotland. Here are the swelling green downs crested with beautiful woodland, reminding one of Sussex or Surrey. Here is a roaring Scotch burn in full spate, the colour of foaming beer, tearing down over grey boulders through a forest of gaunt junipers, which at a little distance might well be pines or firs growing on Scotch mountains. Here you may see the Brecknock Beacons, scenery more mountainous than the Sussex downs, yet with the glorious woods of Surrey, and the aspect over and over again of Wales. The natural meadows are full of blue forget-me-nots or of pink or white clover. In the ferny hollows on the edges of the woodland are innumerable violets (scentless, alas!), buttercups, daisies, and many other English-looking flowers and ferns growing amid the short grass. There is also a very pretty little dwarf iris, which, although not English, is still very European. In marshy spots on the higher uplands grows the golden rod of South Africa—the "red hot poker" of old-fashioned gardens. Here there may be seen in large clumps the extraordinary lobelias, the flower-columns of which grow to a height of 15 feet and more. This beautiful land has not in it a single ugly or unfriendly

* Wrongly spelt—following Sudanese-Arabic mispronunciation—"Shuli." The name really is Acholi, or Atsioli.

spot. Everywhere the landscape is gracious and pleasing in a quiet, homely way, offering few violent forms or startling effects. It is thus singularly home-like, and as it is almost entirely without native inhabitants, it seems to be awaiting the advent of another race which should make it a wonderland of wealth and comfort, a little England, half a Scotland, or a large Wales lying exactly under the equator at an average altitude of 4000 feet * above the Victoria Nyanza, of whose silvery gulfs and ghostly mountain coast-line strange glimpses at a

THOMSON FALLS, SASURU RIVER, SOUTH ELGON.

distance of 90 miles may be caught occasionally from some breezy height or through the interstices of woods which themselves might be in Surrey. These views of a vast but distant seascape, which, owing to the height of the horizon, seem to appear in the sky, give that occasional touch of weirdness to the Nandi landscapes which would be the case in England or Scotland, if amid familiar landscapes we suddenly saw

* In its lowest parts the plateau is 6000 feet, and in its highest over 10,000 feet, above sea-level.

limned in grey or silver in the lower sky the features of a foreign land. In the direction of the Victoria Nyanza, the plateau sometimes crumbles away into broadening river-valleys, through which one descends rapidly from the temperate zone of conifers and buttercups to palms and wild bananas, or ends abruptly in an awful wall 2000 feet and more in sudden drop, or descends in a series of terraces which are covered with a tropical forest, recalling most closely that of the Congo, and possessing much the same fauna and flora. A notable feature of these forests in all parts of the Uganda Protectorate are the butterflies, the colours of which are brilliant even for the tropics. One butterfly, about the size of the English tortoiseshell, is simply pure scarlet all over the upper surface of the wings. Others are pure ultramarine blue, others purple, while there are the usual gorgeous swallowtails of all tints, and huge opalescent *Papilionidæ*. But perhaps the ones that are coloured pure vermilion, and are sufficiently numerous to be a remarkable feature along the path, made the greatest impression on my sense of colour.

When one reaches the north-eastern shores of the Victoria Nyanza, the scenery is disappointing. Kavirondo bay or gulf, that lengthy northern prolongation of the Victoria Nyanza, is a huge backwater of the lake where the water stagnates and entirely loses the blue limpidity ordinarily characteristic of the Victoria Nyanza. It has a dirty green, or even a dirty brown, look. Seen from a distance when ruffled by the wind, it so closely resembles a red ploughed field that it is difficult to believe you are looking on a sheet of water. The ground is either a rank marsh (where the only beautiful feature is the numerous sacred ibises of inky black and snowy white) or harsh rock. There are very few trees, and the principal object in all these landscapes is the candelabra euphorbia, a form of vegetation in which I have never been able to see any beauty.

The people who inhabit this coast-belt are styled Kavirondo. It is difficult to ascertain whence this name arose, but in its origin it appears to have been applied to the Bantu-speaking folk in the Elgon district. South of the Yala river, along the coasts of Kavirondo gulf, right round to the German border, the population belongs mainly to the Nyifwa stock. Physically they offer a somewhat mixed type, which differs little if at all from the average Kavirondo Bantu-speaking population to the north of the Yala river. They speak a language, however, which differs no more than dialectically from the Acholi tongue. The Acholi —incorrectly termed Shuli—is a language which is spoken between the White and Victoria Niles and the northern coasts of the Albert Nyanza on the west and the vicinity of Mount Elgon on the east. The range of this language is limited on the south by the Bantu-speaking people of Uganda, Busoga, and Kavirondo. On the north the extension of this tongue is bounded by the Bari-Latuka-Masai family of languages, which stretches right across to Lake Rudolf; but north of the Bari

tongues appear the Dinka and Shuluk, who speak languages *closely* related to Acholi. At one time or other the Acholi people must have sent important raids to the north-east coast of the Victoria Nyanza, leaving their language behind them to this day. At the present time the Acholi language and the Nyifwa people of this Kavirondo coast are only cut off from their Acholi relations by a narrow band of Busoga, Kavirondo-Bantu people, and also by that strange enclave of Bari-Masai languages—the Elgumi (who come in as a wedge between the Busoga on the west and the Bantu-speaking peoples of west Elgon on the east). Both the Nyifwa and Bantu-speaking Kavirondo on the north-eastern coast-lands of the Victoria Nyanza have been remarkable since the days of Joseph Thomson for their Adam-and-Eve like nudity. They are a most agreeable, friendly people as a rule, and said to be very strict in their morality, but they are absolutely naked and unashamed. A great deal of nudity is seen amongst the men between Kilimanjaro on the east and the Nandi plateau on the west, but in all these countries the women are more or less scrupulously clothed. In Kavirondo the women are as naked as the men.

I will now attempt to give some description of Mount Elgon and its surroundings. I travelled completely round this mountain. Reaching its vicinity first from the settlement of Mumia's on the Nzoia river,* I passed through Bantu Kavirondo, then a narrow belt of Elgumi (a fine, tall people, whose language I have already stated is a dialect closely related to Suk and Masai), and then reached a country on the northern slopes of the mountain inhabited by a branch of the Nandi race whom the Masai call Elgoiny.† It was from this Masai name that Joseph Thomson derived the somewhat incorrect version of Elgon, which is the name under which this great extinct volcano will henceforth be known. This tribe of Nandi race has no collective name for itself. It is closely related in race and language to the Sabei people on the northern slopes of Elgon, and the two communicate one with the other by roads right across the crater. The villages of these people, and of some of the adjoining Kavirondo, are remarkable for the clay walls with which they are surrounded. Outside the clay wall is a deep moat crossed by bridges of earth or planks which correspond with gateways in the clay wall. These gateways are often rudely arched by means of boughs. The style of these clay walls somehow or other strikes the traveller as being due to some teaching from the north, though there is no clue at present to the direction from which this idea came. On the southern, as on the northern, side of Mount Elgon, the awful mountain-cliffs which mark one of the lower terraces of this tremendous crater are

* Often called the Nzeia by the natives.

† It is difficult to express this sound in writing when the *y* comes as a final. It is as though there was a vowel at the end of the word which had been elided.

honeycombed with deep recesses or caverns. The rocks here I find some difficulty in describing geologically. The specimens which I detached for description at home are described as being "augite crystals," "nephelinite," "decomposed rocks," "fossil wood," "augite in volcanic bomb," and "basalt." To a person sadly ignorant as I am of geology, these rocks often appeared as being like sandstone, and in all the stream valleys the pebbles were thickly strewn with black coal-dust and minute pieces of coal which seems to be anthracite. I am quite unable to throw any light on the origin of these curious recesses, which are the well-known caves of Elgon, the caves which were first discovered by Joseph Thomson. They are almost always situated close to the base of a precipitous or overhanging cliff of rock. Man may have enlarged them here and there by hacking at the crumbling and decomposed rock, and this has no doubt been done to some extent. The interior of these caves is blocked up in some cases by houses made of sticks and laths, over which cow-dung and clay have been plastered. The ceiling is of course the sloping roof of a rock. Some of these dwellings are used for the housing of cattle, sheep, and goats, others for human beings. The floor of these caves is, I should say, several feet thick in the hardened excrement of cattle, besides refuse and rubbish thrown down by the humans. The caves so swarm with fleas, and are so noisome from the atrocious stench arising from this ancient manure, that any extensive examination of them was intolerable. I should think, however, that some one with more time and patience at his command than myself on this expedition, and who would endure for a time the attacks of the fleas, might obtain most interesting results by excavating the floors of these caverns. Native tradition never stretches very far back in these countries, but as far as it does stretch, the people declare the caves to have been inhabited from the earliest days of their traditions. Nowadays, owing to the Pax Britannica, they are practically deserted. The natives told me they would only be re-occupied either if war broke out again, or if any unusual drought occurred in the lowlands, obliging them to drive their cattle to these mountain pastures. Several of these caves, curiously enough, are completely concealed from view in front by a curtain of water. The cave coincides with the descent of one of the gloriously beautiful waterfalls for which Elgon should be famous. The path leading to the cave takes you dryshod under a river, and when you are seated at the mouth of the cave you see the splendid glowing landscape through an opal-tinted veil of water. I visited several caverns, but amongst others the one which was the first cave reached and discovered by Joseph Thomson, whose visit the natives still remember vividly. This cave also was masked by a splendid waterfall, a waterfall not represented on the map. It is the descent of the Sasuru river, and I would propose to name the waterfall the Thomson falls, as it has no name in the native

language, and as so many of the waterfalls of Elgon commemorate the explorers who have made this country known. It is hardly necessary to add that Joseph Thomson here, as wherever else he passed in Central Africa, left behind him the most pleasing memories. Fate has ordained that I should often have had to travel in his footsteps, and I have always noted that where he has been the first white pioneer his admirable treatment of the natives has ensured a kindly welcome to those who followed. I might state that one of the minor chiefs of this

PAPYRUS MARSH, UGANDA.

part of the mountain, who guided me to the Thomson falls and showed me the caves, possessed as a relic of Joseph Thomson half a *Nineteenth Century Review*, a copy of that review which had been cut in halves and left behind. This the man believed to be a kind of treaty with the white man, and he always exhibited it with one end clutched firmly in his hand, so that so precious a document might not be taken from him.

The vegetation on the western flanks of Elgon is extremely rich, and quite West African in character; whereas on the other sides of the

mountain it is essentially East African. The scenery on the western side is perhaps grander and more beautiful in its details than on the other aspects of the mountain. Tremendous buttresses and precipitous sides of gleaming granite or quartz advance from the great blue crater wall into the Bukedi plains. An excellent road has recently been made all round the face of the mountain by an enterprising Uganda chief, whom I had placed temporarily in charge of this district. From this road one obtains the most beautiful views of lakes and marshes in the direction of those vast backwaters of the Victoria Nile. The native inhabitants of west Elgon are of the greatest interest. They are of rather a mixed stock, but all are of very low and ape-like appearance. Some stunted individuals recall irresistibly the Pygmies of the Congo forest, whom they closely resemble in features and low stature. Others, again, remind one of those strange, ape-like pariahs seen by Messrs. Grogan and Sharpe, myself, and others on the eastern edge of the Congo forest. The greatest interest they possess, however, lies in fact that they speak a Bantu language which, of all those discovered, possibly comes nearest to the original form of the Bantu mother-tongue. I have no space to dilate on the features of this language in this article; I must reserve my account of it for my book. I might, however, call the attention of the Society to this interesting fact. That great philologist, the great Dr. Bleek, who invented the name Bantu, and who was the first to give any definite account of the features of the Bantu languages, attempted to reconcile curious differences of form between the prefixes and their corresponding particles or pronouns, and also to explain the origin of that preliminary vowel which begins the prefix in so many Bantu languages of archaic type. He drew from the small evidence at his disposal the brilliant deduction that originally the prefixes were in a much more ample form of two syllables. It would be out of place if I gave all the particulars here, but I might say that these Bagesu people of west Elgon exist at this day to confirm Dr. Bleek's hypothesis, for they utter prefixes almost exactly in the form which Dr. Bleek believed must have represented their original condition. This language, in fact, almost more than any other, will enable us to reconstruct the original form of the Bantu prefixes, and to explain changes which have since occurred to differentiate the prefix from its corresponding pronoun.

The Sabei people of north Elgon are, as already stated, another branch, and one of the most northern, of the Nandi stock. They are mostly a handsome people, but occasionally possess wives whom they have captured in warfare from the hostile Bantu to the west of them, and these women are hideous and ape-like. From the Sabei country, which is mostly at an altitude of 7000 feet, one can distinguish clearly the outlines of Lake Salisbury, Lake Gedge, and of the swampy rivers that feed these open stretches of water. One can even see to the north

the Nakwai hills and the heights of Karamojo. Prominent objects on the north-east horizon are the splendid mountain mass of Kamalinga and the still more picturesque peaks of Debasien. So far as outline goes, I think Debasien is the most beautiful mountain I have ever seen in Africa. Its height is given on Colonel Macdonald's map as not exceeding 9700 feet. This is probably correct; but as the mountain rises sheer from a plain whose altitude is not much over 3000 feet, it appears much more lofty, and at a guess one would give it 11,000 feet at its highest point. Parts of this mountain appear to be richly clothed with forest, but as the eye wanders over the vast plains to the north one can easily distinguish decreasing vegetation and a commencement of that sterility which afflicts so much of the northern parts of the Uganda Protectorate. To the east of Debasien rise the Suk and Karamojo mountains in fantastic forms, some of them with crags thousands of feet in height, which appear to be falling over. To the south-east of Debasien the northern buttresses of Elgon stretch out towards the Suk highlands in a series of hills or hillocks of strangely regular, conical shape, as regular in their pyramidal outline and the sharpness of their apices as if they had been made by man. To the north-east of Elgon one touches that average East African dryness and poorness of vegetation which is so characteristic of the lowlands between Abyssinia on the north and Nyasaland on the south. The courses of rivers are dotted here and there with tall shady trees, but outside these there is a paucity of vegetation which, I confess, after the rank luxuriance of west Elgon, was rather welcome.

From the Sabei country I was obliged to travel for sixteen days to the Ravine station without a road, simply guiding my caravan by the map and eye. Occasionally I would lead them to the edge of a morass, or to an unfordable river, or to a ravine of such precipitous sides that it was untraversable. Then a *détour* had to be made. But for the most part the country was an easy-going steppe, relatively merciful in its moderate development of vegetation. From the north-east of Elgon to within sight of the Ravine station, we passed through a land whose only human inhabitants were a few wandering and fugitive Andorobo, a land simply swarming with big game. We saw large herds of elephants firstly; then many rhinoceroses; then literally countless hartebeests, water-buck, reedbuck, Cobus antelopes, bastard hartebeests, and oribi. Herds of zebras would follow the caravan, snorting and kicking up their heels. There were lions, leopards, wart-hogs, jackals, and many ostriches. Last of all, in the middle of the Gwas 'Ngishu plateau, where forests of acacia still lingered, and before the elevation of the ground had led us to the region of the conifer, we came upon giraffe, upon this five-horned giraffe which appears to be a new species of that remarkable animal, and apparently the common form of giraffe between Elgon on the west and Lake Baringo on the east. Seen from

a distance, these giraffe appeared, when adult, to be black and white, black with white bellies and limbs. Here and there monsters stood on the tops of large anthills or small hillocks, sentries posted to warn the feeding herds of the approach of the giraffe's only enemies, man and the lion. Yet so little had man harassed these creatures during recent years, since the plateau was divested of its human inhabitants, the Gwas 'Ngishu Masai, by civil wars, that these sentinels seem to have taken little or no notice of our caravan. Feeling sure that there was something unlike the ordinary giraffe about these beasts, I sanctioned the breaking of one of our game regulations, and myself with the aid of Mr. Doggett secured four specimens—two males and two females—for the British Museum. This animal will have been described by Mr. Oldfield Thomas in the *Proceedings of the Zoological Society*.

It is a great contrast to pass from regions like this to the islands of the Victoria Nyanza, and these again differ markedly in appearance one from the other. Some of these islands consist of little more than enormous smooth monoliths, or great boulders of rock piled one on the other as though they were enormous ruins of a Cyclopean race. Some of these rocks are snowy-white with the guano of cormorants and other water-birds, who make them their perching or nesting places. Again, other islands have sandy shores, and are covered with the most luxuriant forest. Others again rise into green downs above the forest-level. The island of Buvuma is a little world in itself, and resembles very much in shape the island of Celebes. In Buvuma the downs rise into mountains of more than 2000 feet above the level of the lake, heights which will prove valuable and accessible as sanatoria for the white settlers on the shores of the Victoria Nyanza. The island of Buvuma is of great interest. Its inhabitants belong to the same stock as the Busoga, and do not differ markedly in appearance or language from that people, or from the kindred Baganda. But for a hundred years or more there has been a deep-seated feud between them and the Baganda. Many a king of Uganda has endeavoured to conquer Buvuma and has failed. At the present time a Muganda chief is stationed there as resident, but the affairs of the island are supervised by that excellent servant of the Uganda Protectorate, Mr. Grant, who is the Sub-Commissioner for the Central Province. In Buvuma the people have resolutely refused Christianity, and they adhere to the old fetishistic religion. They worship at least ten *Balubari*, or spirits. The worship of these spirits is chiefly carried on by offerings of food and drink that are placed in little huts outside the village. These huts of grass are surmounted by a long peak or steeple made of sheaves of grass. Sometimes, however, the fetish-place is a hollowed stone, and over this is suspended a large grass "extinguisher" hung from the bough of a tree. In Buvuma it seemed to me as though many of the plants and birds differed from those of the mainland, but my ideas on this point have

A GENERAL VIEW OF THE RUWENZORI RANGE TAKEN FROM AN IMAGINARY HEIGHT OF 10,000 FEET E.N.E. (TO GIVE A PANORAMIC IDEA OF THE SNOW-PEAKS, ABOUT 30 MILES FROM NORTH TO SOUTH).

not been much confirmed by the specimens collected. Still, I should think that in many respects this island deserves very careful examination.

Busoga, which together with Elgon constitutes the coastland of the Central Province on the Victoria Nyanza, is a fertile, well-forested country on the east side of the Victoria Nile, closely resembling Uganda in its appearance, productions, and people. It is the first definite taste of West Africa which the traveller coming from the Indian ocean gets as he advances towards Uganda. The Sio river, one of the few streams which actually enter the northern half of the Victoria Nyanza, is a very well-marked boundary between the open grassland of Kavirondo, with its naked people, and the well-forested, hill and marsh country of Busoga, whose inhabitants, however poor they may be, are scrupulously clothed. Here one sees the grey parrot and many West African forms of Turaco in abundance. The language of the Busoga differs very little from that of Uganda, and the people are in the main of the same stock.

Busoga is separated from Uganda by the Victoria Nile, which, in its birth at the Ripon falls, gives us one of those glorious bits of scenery that make this world so hard to leave. I shall not attempt here to describe the scene, which has been frequently described before from the days of Speke onwards. The Victoria Nile loses itself for a while in the huge backwaters of Kioga, Kwania, and other lakes and marshes. Here the country is for the most part low and exceedingly swampy, and therefore very unhealthy for Europeans. Cleared of sudd, however, the Victoria Nile is navigable for steamers from a point about 55 miles north of the Victoria Nyanza all the way to Foweira, which is on the borders of the Nile province, and not far from the Albert Nyanza.

The geographical features of Uganda proper extend, as I have already said, eastwards of the Nile over Busoga. They are also continued westwards into a portion of Toro and into Ankole, and southwards into Karagwe. These geographical features consist of hummocky hills (rising here and there into lofty downs), with broad marshes intersecting this lumpy country. Over almost the whole of Uganda proper and the surrounding countries, which resemble it in appearance, there is scarcely to be seen a real running stream or river, the only exceptions being the Kagera on the south-west and the Nile on the north. Almost every watercourse is so choked with vegetation that from a height the water is not visible, and the broad river-valley seems to be a stretch of light green sward. Sometimes, however, these valleys in between the hills are filled with forest, the tropical luxuriance of which cannot be beaten in any part of Africa that I have seen. These Uganda forests surpass in splendour of vegetation and in loftiness of trees the finest forest effects I have seen on the Congo, the Cameroons, in the Niger Delta, and in Liberia. But even in these forest depths, where the valley is deepest, the water scarcely seems to flow or percolate, and

has all the appearance of stagnancy; and even here its course is almost completely hidden by the growth of weeds, reeds, grass, rushes, and zingiberaceous plants, some of these latter with splendid leaves which might take their place amongst ornamental foliage in greenhouses. Where the river-valley does not support this extravagant forest, it is completely covered with papyrus and other water-plants. These papyrus rushes will grow to a height of 9 or 10 feet sometimes from the surface of the water. The Baganda have carried across these marshes in all directions fairly solid causeways, made by driving stakes into the ground, and then constructing between these stakes a sort of corduroy road on which sand is piled.

A familiar spectacle in Uganda is the magnificent banana plantations, which constitute the main source of food-supply.

The huts of the common people are poor and untidy in appearance, and do not correspond with the relatively high position which the Baganda occupy in other respects amongst African peoples. The chiefs, however, erect buildings of reeds, palm-trunks, and thatch, which are imposing and often elegant in appearance. The Baganda are a very carefully clothed people, who are almost more squeamish about any exposure of the person than Europeans. Yet they are a much less moral race than the naked Kavirondo, though Christianity is exercising a decidedly elevating influence on their habits in this respect. This is perhaps the only adverse thing that can be said about them, for in other respects they are the most amiable and charming black race I have ever encountered. In politeness, quickness of intelligence, and appreciation of beauty, they are the Japanese of Africa. I am convinced that a very great future lies before the Baganda, if they are properly led forward in a wisely administered British Protectorate. So much, however, has been written about them and their country, that it would be a needless waste of space if I were to repeat observations which have already been made by the many who have visited and reported on this country.

I have only seen the southern part of Unyoro. It differs chiefly in appearance from the adjoining parts of Uganda in the much less frequency of swamps and in the greater rockiness of the downs. In southern Unyoro the extraordinary naked boulders which are piled one on the top of the other on the summits of hills bear the most marked resemblance to ruined castles, and are picturesque in the extreme. In western Unyoro, not far from the coast of the Albert Nyanza, there is a magnificent stretch of forest, quite West African in flora and fauna. I have seen the southern portion of this forest, and have obtained from it chimpanzees, which I have sent to the national collections. This stretch of typically West African forest extends almost uninterruptedly from the vicinity of the Victoria Nile (near its entry into Lake Albert) southwards, parallel with the coast of the Albert Nyanza (but not

reaching it), through eastern Toro, parallel with the Ruwenzori range but not joining with it, into northern Ankole. The country along the coast-line of Albert Nyanza drops abruptly from the Unyoro plateau, and is somewhat harsh in character, partly owing to the presence of salt in the soil. This harsh-looking country extends along the south end of Albert Nyanza, varied with huge marshes. About 30 miles from the lake-shore, however, in a north-westerly direction, one suddenly enters a belt of extravagant West African forest, a forest which is now quite continuous with that of the Congo. This belt of dense woodland stretches eastwards to the north-western flanks of Ruwenzori, and then turns again westwards, and leaves the Semliki flowing through a strip of country quite East African in appearance, with long grass and sparsely foliaged trees—euphorbias, etc. This is the country which characterizes the greater part of the shores of Albert Edward Nyanza, except a portion of the eastern shore, where there is another patch of West African forest, which is really a termination of the Unyoro belt. In the region between Ruwenzori and the heights of the Congo watershed—in fact, on either side of the upper valley of the Semliki—there is a great deal of East African big game; there are fan palms (*Borassus*); and there are those large vultures which are particularly associated with the steppe regions of Africa where big game abounds. A march or two to the west of the Semliki brings one to a rather high mountain range, the flanks of which are clothed in dense forest. This is the forest which stretches uninterruptedly to the upper Congo, and which crosses the lower part of the Semliki till it touches the flanks of Ruwenzori. This Congo forest, however, avoids the western shores of Albert Edward Nyanza, and trends in a south-westerly direction towards the upper Congo. The mountain range west of Albert Edward Nyanza has a most imposing appearance, possibly due to some mirage or moisture in the atmosphere, which gives the mountains an exaggerated appearance of height, so that on some days one strains the eyes to see if snow does not lie on them. This deceptive appearance has actually caused certain travellers to place hypothetical snow-peaks in this range which have no existence. The Belgians, indeed, assured me that the greatest heights of these mountains have been ascended by them, and are found not to be more than an approximate 6000 feet above sea-level. They are no doubt right. This same range, however, close to the south-west coast of Albert Nyanza, does rise to heights of over 8000 feet, and I cannot help thinking that altitudes of 8000 or 9000 feet may still be found to the west of Albert Edward Nyanza. The fauna of this mountain range is East African, and not West African. It is rather interesting to notice how sharp is the demarcation in this direction of the range of two species of buffalo. The Cape buffalo, with its large and recurved horns, still lingers in the Semliki valley outside the forest. The instant you enter the forest, however, you see individuals

or encounter traces of the Congo species of buffalo, with its greatly reduced horns and shaggy red hair.

I crossed the Semliki river opposite Fort Mbeni, and travelled for three days into the dense Congo forest. I can fully endorse all that the celebrated explorer Stanley has said about the awesome nature of these appalling woods. I can only say that the whole of my expedition, as well as myself, longed to be out of them, although we were in search of the now well-known Okapi and of other wonders, some of which were found, and some of which still remain undiscovered. I employed my time in this forest profitably by visiting the Pygmies at home, and seeing their little settlements of tiny huts constructed of withes and leaves. I also encountered here those strange prognathous, ape-like

VEGETATION ON MUBUKU RIVER, RUWENZORI, AT 8500 FEET.

people who seem to be a race of pariahs dwelling on the fringe of other tribes. They are locally known as the Ba-nande. I made some interesting discoveries about the Bantu languages spoken in these forests, and the adjoining tongues which are not Bantu, but are apparently distantly related to the Makarka, or Nyam-Nyam. I also ascertained that the real gorilla comes pretty near to the Semliki in its distribution.

I have reason to believe that other remarkable discoveries of hitherto unknown mammals will be made beside that of the Okapi. As it was, in this forest we obtained skins of several other beasts new to science. I might mention that I was accorded the kindest hospitality by the Belgian officials, and given every possible facility for visiting this portion of the Congo Free State. I found the natives everywhere on friendly terms with the Belgian authorities, and the excellent roads and

well-built stations, together with abundant supplies of the comforts and necessaries of existence from Antwerp merchants, introduced a strange element of civilization into these otherwise trackless wilds. Sir Henry Stanley would indeed be amazed at the change which has taken place in parts of the forest which some twelve years ago were to him and his expedition more remote from civilization than the north pole.

Regarding the Pygmies, I might mention that I have examined individuals from several different parts of this northern province of the Congo Free State and from adjoining British territory, for a few Pygmies dwell within the limits of the Uganda Protectorate in the Mboga country. As the result of my inquiries, I have come to the conclusion that there is no special Pygmy language; that each section of Pygmies speaks more or less imperfectly the language of the tribe of forest Negroes with which it most associates. Thus, some of the Pygmies speak the corrupt Bantu dialect of the Babira, while others speak such languages as Mbuba, Lega, and other tongues that are not Bantu. The Pygmy pronunciation, however, is constantly punctuated by little gasps which take the place of consonants, and which have a far-off resemblance sometimes to the South African click. They also speak with a musical pronunciation that is strongly cadenced. My measurements of the Pygmies and other particulars I shall have to reserve for the *Journal of the Anthropological Institute.*

The south-western part of the Uganda Protectorate consists of the district of Ankole. A portion of this noble country rises to heights of 8000 and 9000 feet, and here reappears the alpine vegetation of Ruwenzori, Elgon, and the Nandi plateau. Amongst these mountains are scattered almost innumerable crater-lakes, which provide landscapes of exquisite beauty. I shall never forget my first glimpse of one of these basins of sweet, clear blue water. We were at the end of a long and very weary march, and I was ardently desiring to find water for the thirsty men, so that we might camp and rest. We had been constantly ascending, and I had looked out in vain for any rill or rivulet. At last my guide said water was quite close, and proceeded to commence the ascent of an extremely steep cone covered with short turf. I followed in perplexity, reached the edge of the cone, and suddenly looked down a few hundred feet into a lakelet which was an absolute mirror of banana-covered shores. Some of these crater-lakes look as if two craters had coalesced. They are of rather large size, swelling out here, narrowing there, and swelling out again. They nearly all contain fish. The scenery round them is so extravagantly beautiful that I feel that—coupled with the fact that they are in a country possessing a very healthy climate and few inhabitants—they may some time become the seats of small European settlements.

The southern part of Ankole is somewhat dryer and less equatorial in climate. It has a more parched appearance, at any rate, during the

dry season, and it falls in altitude. Here there is a certain amount of big game, including buffalo, rhinoceroses, and eland. The people of Ankole, as is well known, consist of a race of sturdy Negroes—the Ba-iro—and an aristocracy of Ba-hima, who are, as Speke, their original discoverer, guessed at once, obviously descended from a Gala, Somali, or other Hamitic stock. As regards features and complexion, one often sees men and women amongst the Ba-hima who are more like Egyptians than is the case with the Galas and the Somalis. But, strange to say,

SENECIO (? *JOHNSTONI*) ON RUWENZORI AT 12,500 FEET, DRAPED WITH *USNEA* LICHEN.

the hair of the head is much more woolly and Negro-like than is the case with Galas and Somalis. I have seen some men and women so light in complexion that I actually thought they were some of Emin Pasha's refugee Egyptians, until it was proved to me that they had been born and bred in Ankole. These people, no doubt, are the origin of many of the legends of a white race dwelling in Equatorial Africa. Amongst many other points, they are remarkable for their domestic cattle, which have more or less straight backs, are of large size, and have

enormous horns. The horns sometimes remind one strongly in shape of those of the Bibontine section of Asiatic wild oxen. On the whole, the breed agrees remarkably closely with the long-horned cattle depicted in the Egyptian frescoes, and I believe that this race is the stock from which the long-horned South African cattle were derived.

I conclude this already too lengthy paper with an account of my exploration of the Ruwenzori range of snow-mountains.

Ruwenzori is still the most mysterious and least-known mountain of Africa. Its existence as a snowy range, or a single snow-peak, was reported by Stanley on native information as far back as 1875, though, curiously enough, at that time he does not seem to have attached sufficient importance to the natives' stories of snow, which he repeats without comment. Yet he himself stood, in 1875, close to the eastern flank of this mighty mountain mass, and spent days if not weeks within sight of it. The whole time, however, the upper regions of the mountain remained completely veiled in clouds, and Stanley vaguely estimated an altitude of 15,000 feet as the possible climax of this imperfectly outlined mass of blue mountains. All the time Sir Samuel Baker, Gessi Pasha, and other explorers or officials of the Egyptian Sudan were navigating Albert Nyanza, the snow-summits of Ruwenzori remained obstinately concealed behind banks of clouds. Sir Samuel Baker was struck with the apparent size of the great mountain mass which lay to the south of his newly discovered lake, and he gave it the name of the Blue mountains. When Stanley reached the vicinity of the south-west corner of the Albert Nyanza in 1887, he got a sight for the first time of a snow-peak, or indications of a snowy range of mountains, to the south-east of his position. Questioning the Bantu-speaking populations at some time or other when in the vicinity of this new discovery, he believed the most general native name for it to be Ruwenzori. Unfortunately, this term is nowhere recognized by the natives. The nearest approach to it seems to be, on Dr. Stuhlmann's authority, the Lukonjo word *Nsoro*. This, with the Lu- or Ru-prefix would be *Runsoro*, and it is obvious that Stanley unconsciously extended the pronunciation into Ruwenzori. In the Nyoro (Urunyoro) language the snowy part of the range is called *Enchurru*, which is probably a variant of the same root as the Lukonjo *Nsoro*. It is only on the authority of Stuhlmann, one of the few really careful observers and writers who have visited this region, that I give this explanation of the name Ruwenzori. I have made a very careful study myself of the Urukonjo language,* and the nearest I can get is *Nsororo*, which with the plural prefix *esi* (*esiansororo*) means "snow" or "snows." As a matter of fact, Ruwenzori is more often called by the Bakonjo

* Because it comes almost closer than any other tongue (except Lugesu) to the conditions of the Bantu mother-language, from which all the other dialects diverged.

who inhabit its southern half *Obweruka*, and by the Banyoro, who are the native rulers of the country, *Ebirika*. By the Ba-amba who dwell on the north-western flanks, and whose very name means "People of the Heights," it is called *Gusia*. By the people speaking corrupt Bantu dialects on the north-eastern edge of the Congo forest it is styled *Tudu*. The Baganda call this mountain range *Gambaragara*. The people dwelling to the south of Albert Edward Nyanza, who speak variants of the widespread Nyoro speech, appear to call the mountain *Gularo*. Amidst all this diversity of names, it is perhaps best to retain Stanley's somewhat incorrect version of Ruwenzori, though if only the spelling of this word could be reduced to Runsori, it would correspond more closely with one of the native designations.

After my own experience in regard to this mountain I am no longer surprised that explorers like Stanley in his first visit to these countries, like Emin Pasha, Sir Samuel Baker, Gessi, and all others who visited these regions prior to 1887, failed to discover in the "Blue mountains" south of Albert Nyanza what is probably the highest point of the African continent, and what is certainly the greatest extent of snow and glaciation in Africa at the present day. I was within sight of Ruwenzori for three months and a half during my investigations of the Western Province of the Uganda Protectorate and of the adjoining regions of the Congo Free State, and only six times did I see the snows, except, of course, that period of a week during which I was more or less on the snow. And out of all these times when, in the early morning or late evening, I caught sight of the snow, I only once saw without intervening cloud the whole snowy range. On this occasion, unfortunately, the photographs which I took came out with plenty of foreground and practically no indication whatever of the snowy panorama behind; and the period during which the continuous range of snow was visible was too short for a sketch of any value or accuracy to be made.

The same fate appears to have attended all my predecessors who were armed with a camera, a pencil, and a notebook, with the exception perhaps of Dr. Stuhlmann, who in his book gives us a sketch of the distribution of snow on the western aspect of the mountain. Even this sketch, however, is not a complete record of the entire range of snow-peaks. For myself, piecing together as correctly as I can all my separate sketches and photographs of each of the peaks covered with snow or glaciers which I saw separately, I have arrived at a result which may give an approximately correct representation of this snowy range as seen from the east. But this drawing, being intended to show the actual extent of snow, is taken from an imaginary standpoint to the east-north-east of Ruwenzori, which would be of an altitude nearly as high as the range itself. It does not represent the actual aspect of the mountains from any accessible point of view to the east of it, because from the lower altitudes of Toro parts of the snow would be cut off by

intervening heights forming parallel ridges or divergent spurs of the main mass. Ruwenzori is certainly, of all African mountains of my acquaintance, that which is the most constantly cloud-covered. For a month or more at a time no glimpse may ever be obtained of the snow. I am told, however, that I visited this region at the worst time of the year for my purpose, and that I should have had much better luck with regard to seeing the snows during November and December, which are said by residents to be the months of the clearest skies. With regard to the highest point of this range, the selection would appear to lie between the peaks known to the natives as Kiyanja and Duwoni. These would be apparently the Semper Berg and Weismann of Stuhlmann. I must say, however, that I strongly object to christening the heights of Ruwenzori for all time with the names of German worthies like Kraepelin, Semper, Weismann, and Moebius, who are not all of them of world-wide reputation (however much they may be esteemed in their own country), and who have had absolutely no connection whatsoever with Africa or with Africa's highest mountain. The preferable plan would be the search in the first place for clearly defined and easily pronounced native names, and in the event of these not being obtainable, to christen the separate peaks of Ruwenzori with the names of Stanley, Stairs, Emin, Bagge, Moore, Elliot, and Dr. Stuhlmann himself—of explorers who from time to time contributed their share to the exploration of this Caucasus of Central Africa.

I am personally convinced that the highest point of Ruwenzori is not under 20,000 feet in altitude, and that it will therefore be found to attain the greatest altitude on the continent of Africa. There must be over 20 miles of almost uninterrupted glaciers along the highest part of the ridge, and this under the Equator must pre-suppose a very considerable altitude. Apart from which, when, after the most arduous climb I have ever experienced, I reached my highest point on the flanks of the snow-range—14,800 feet—the mountain above me seemed a thing I had only begun to climb, and towered, so far as I could estimate, another 6000 feet into the dark blue heavens. Permanent snow, however, lies as low as 13,000 feet, which also is the lowest point to which any glacier reaches, so far as my limited investigation extends.

To effect a complete and successful ascent of the highest points of Ruwenzori requires as elaborate a preparation as the exploration of the Andes or Himalayas. An enormous deal remains to be done in the exploration of this the most important range of Africa. Hitherto we have had mere peeps at this series of snow-covered heights. The only Europeans who have as yet topped the snow of Ruwenzori are Mr. Bagge (formerly collector for the Toro district), Messrs. Moore and Ferguson, and myself and my two companions, and we have only touched it at one spot, the head of the Mubuko valley. Ruwenzori is no Kilimanjaro or Kenia, no single snow-mass. It is a chain of heights like

the Caucasus, with considerable intervals between the principal masses of snow and ice. The snow-peaks of this range probably extend over a distance of 30 miles from north to south.

The obstacles which prevented myself and other explorers from reaching the highest points of Ruwenzori were, firstly, the distances to be traversed at high altitudes, with a temperature not far off freezing-point; the extremely arduous nature of the last part of the climb, where precipitous walls of rock or ice require an alpine equipment for their ascent; the non-existence of any guides whatever above snow-line; and deficiency in the means of transporting the necessary means of shelter and supplies of food. Above 13,000 feet it is difficult to see where shelters could be formed or tents pitched which would protect the explorer from the severe cold prevailing at night-time, as the rocks and glaciers were so precipitous. Even between 13,000 and 9000 feet it is extremely difficult to find a dry spot on which to pitch a tent or to build a hut. The ground above 9000 feet and up to the snow-level is almost everywhere either bare rock or wet moss, sodden vegetation into which one may easily sink to the knees. This belt round the mountain is simply a sponge, over which it is impossible to pass dry-shod. Mr. Bagge, formerly collector for the Toro district, and now sub-commissioner for the Nile Province, deserves credit for making a rough corduroy road, with the help of the natives, over this marshy belt between 9000 and 13,000 feet; but even he could do little to mitigate the difficulties of the ascent in many places. After going nearly all round the base of Ruwenzori, from the north southwards to the north-west, during the months of June, July, and August, I made arrangements in September to attempt the ascent of the higher snow-peaks by way of the Mubuko valley. The natives had informed Mr. Bagge that the Mubuko valley was the only possible means of reaching the snow by any ordinary feats of climbing, and it was due to guides furnished by Mr. Bagge that Messrs. Moore and Fergusson were enabled to make their partial ascent in this direction. I followed along the same route. After passing through tropical scenery of the usual luxuriance to be expected in a well-watered part of Equatorial Africa, I reached a little Mukonjo village called Bihunga, at an altitude of 6800 feet. From this point a superb view could be obtained up and down the Mubuko valley, and one faced a long serrated ridge of densely forested mountains, which are a very prominent feature on the eastern aspect of the Ruwenzori range. They look at a distance like a sierra or comb, which acts as a jealous screen to hide the snow-range. As, approaching the mountain in this direction, they serve as the awful portals of the snow—I call them awful because they are so, rising up precipitously thousands of feet above the narrow river-valley into cloudland—I venture to call them the Portal peaks, and this name will also serve to commemorate the services of Captain Raymond Portal, the brother of Sir Gerald Portal, whose

political work in the Toro district, short though it was, has proved of inestimable benefit to the country, and, curiously enough, has had much more important results than the mission of his more celebrated brother, which resulted in no settlement at all of the Uganda questions.

The following may be a useful summary of the general character of the vegetation on the slopes of Ruwenzori between 6000 and 15,000 feet. At 6000 feet dracœnas and tree-ferns mingle with the tropical forest. A large daisy growing in the grassland has a strangely northern look. Buttercups and forget-me-nots also make their appearance at this altitude, though they are not abundant until 7000 feet is reached; tree-ferns do not ascend above 7000 feet. At this altitude the forest begins to lose its tropical character, and a conifer, *Podocarpus*, makes its appearance, and ranges between this height and 10,000 feet. I noticed on Ruwenzori no species of juniper, though I have seen junipers on Elgon and all the eastern heights of the Uganda Protectorate. I do not know if this conifer, so common in Abyssinia and on the high mountains of Eastern Africa, is absent from Ruwenzori. The podocarpus tree is an extremely handsome one; the leaves are much longer than in the yew, so long that they almost look like the foliage of the eucalyptus. The old leaves are a rich, dark, glossy green, and the new leaves a vivid yellow-green, so that the foliage is full of colour, the more so as the catkins and cones are a lovely mauve-pink. The podocarpus gives out a smell exactly like the English yew. The tree must grow in places to 70 or 80 feet in height. One species of tree-heath begins at 7000 feet and ascends to 9000 feet. An enormous species with slightly larger leaflets replaces it at 9000 feet and ascends to 12,900 feet. Bamboos begin at 7000 feet and ascend to 9000 feet; proteaceous shrubs begin at 7500 feet and ascend to 12,000 feet. A species of hypericum, very like the English St. John's wort with yellow flowers, begins at 8000 feet and ascends to 10,000 feet. At 10,000 feet a fine hypericum, growing as quite a tall tree, makes its appearance. This has very large flowers, with a calyx that is bright yellow inside, but vivid crimson on the outer side of the petals. Between 7000 feet and 9000 feet the Abyssinian violet grows abundantly. Moreover, there is a bramble, the flower of which is strangely similar to that of a wild rose. This bramble has a large fruit like an English blackberry. Another bramble or raspberry has a fruit the size of a strawberry, but in appearance somewhat like a hop. Umbelliferous plants, like wild carrot or hemlock, grow luxuriantly between 8000 and 11,000 feet. A senecio, or giant groundsel (exactly like *Senecio johnstoni* of Kilimanjaro, but, I am informed, a species new to science), commences at 9500 feet and grows at least as high as altitudes of 15,000 feet. *Habenaria* ground orchises grow from 9500 to 11,000 feet. A flower very like the English "lady's smock" grows between 8500 and 12,000 feet; a white flower of the cabbage order grows under cliffs at 12,500 to 13,000 feet.

Perhaps the most remarkable feature in the vegetation of the upper parts of Ruwenzori are the lobelias. These are of two kinds, and are so utterly distinct one from the other in form that no one but a botanist would know that they were closely related. One of these lobelias, perhaps offering two separate species, begins to make its appearance above 7000 feet, and continues (or else reappears again in a closely allied form) right up the mountain to the very verge of the snow, and in places without snow to 15,000 feet. This lobelia grows exactly like a dracœna. As the plant shoots upwards the lowest leaves fall off the stem, leaving it round and smooth, so that when the plant has attained its maturity it exhibits a large bunch or mop of sword-like leaves at the end of a woody stem of small diameter, and about 20 feet and over in height. From the middle of the mop of leaves there starts a flower-spike, which may be as much as 3 feet in height. This is at the same time very slender, and is covered throughout the whole of its length with blossoms concealed from sight by large green bracts. The blossoms, when examined, are found to be of a greenish-white, inclining to red. The other kind of lobelia is similar to one existing on Mount Kenia. Its general appearance is best described by the accompanying illustration (p 32). It reaches to a total height of about 15 feet above the ground. The flower-stalk is sometimes nearly 6 feet long, and is much thicker and larger than the first described lobelia. The green bracts to a great extent conceal the ultramarine-blue flowers, which grow at right angles to the stalk, though when the flowers are absolutely mature they reveal for a day or two an exquisite shimmering of blue all up and down the stalk. These lobelias with their aloe-like leaves and strange flower-columns remind one, I cannot say why, of monuments in a cemetery. They would certainly be handsome additions to our ornamental flora. I have already alluded to the senecios, or giant groundsel, on the upper parts of the mountain. I am informed by the authorities at Kew that the specimens I have sent home show this to be a new species, but in outward aspect it scarcely differs from the giant senecio which I discovered on Kilimanjaro. Like that plant, it grows to a height of over 20 feet, and has broad, bright green leaves like a cabbage, or even in some aspects like a banana. The flower-stalks grow above the leafage to the extent of perhaps 2 feet, and their masses of flowers are a dull amber-yellow. The plant would be handsome but for the swollen, gouty stem. Very often, however, all the lower part of it is exquisitely draped by long fringes of the *Usnea* lichen, and then it is a really beautiful object in the landscape.

A description of the upper parts of Ruwenzori would not be complete without an allusion to the extravagant development of mosses on the tree-trunks between 11,000 and 12,000 feet. This growth of moss is extraordinarily thick. Perhaps it would give a depth of 18 inches

before the stem or trunk on which it grows was reached by a probing instrument. A portion of one's road up the mountain lies for perhaps 2 miles over a constant succession of prone tree-trunks. For ages past tree after tree in this wintry-looking forest has fallen from old age or in storms, to lie prone where it fell, apparently without insects to turn its wood to powder. On the contrary, this wood becomes hard like bog-oak, and is covered with this thick growth of moss. But the moss makes these tree-trunks most deceptive and dangerous to step on, as it

A STRANGE GARDEN. LOBELIAS GROWING AT 11,500 FEET (RUWENZORI).

is so lightly attached that it slips away from under the foot, and the incautious traveller may fall and hurt himself most cruelly against the jagged branches of the trees, which have been turned to a flinty hardness. But these mosses give one a perfect feast of colour. They range in tint from lemon-yellow up through all the gamut of yellows and browns to a deep rich red, a red which at times has almost a purple tinge. Sometimes the moss is almost an emerald-green, and the limbs of the same tree may display every shade ranging between purple-red and grass-green, a large proportion of the colours being shades of

orange and yellow. Yet the forests of this cold zone of Ruwenzori at a distance fuse their tints into rather a dreary tone of drab-green, and the long streamers of the greenish-white usnea give the vegetation a singularly dismal aspect. It is, perhaps, at about 9000 feet that the European traveller feels most at home, as at that altitude many of the flowers, and not a few of the trees and ferns, recall to him the woods of his own country.

Leopards ascend the mountain to the very verge of the snow, and we actually found a leopard's footprints in the snow at 13,400 feet. The trades of a large serval cat, probably the Servaline, were found at 12,500 feet. There are two kinds of Hyraxes on Ruwenzori at least, if not

SNOWS AND GLACIERS ON SOUTH SLOPES OF MOUNT DUWONI (MUBUKO VALLEY), RUWENZORI. TAKEN FROM 12,500 FEET.

more, and they also ascend to the snow-line. Bats were found up to 13,000 feet. Chameleons were found up to 11,000 feet, and a whitish moth fluttered about over the snow. A large eagle owl was seen, but not secured, at an altitude of 13,000 feet; and at this height a common bird was a kind of starling with a fan-shaped tail, very similar to one which we saw and obtained at 7000 feet on Mount Elgon. We saw elephants on Ruwenzori, but not higher than 7000 feet. Monkeys do not appear to go above 9000 feet. A few rats were obtained not far from the snow-line, and francolin, very partridge-like in appearance, were met with as high as 13,000 feet.

The rocks in many places are very micaceous. In some of the

caverns which I am about to describe, the overhanging roof of rock was like burnished silver, and had much the appearance of the beautiful aluminium ceiling to be seen at Sir Alma Tadema's house at St. John's Wood. A good deal of granite crops out between 10,000 and 11,000 feet. Many of the stream-valleys exhibit rocks that are almost jet black in colour, with white veins of quartz.

Among the volcanic foothills of Ruwenzori which fringe the northern and eastern borders of the mountain range, there are so many crater lakes that I have hardly been able to keep account of the number visited or seen. All of these, with one exception (so far as my knowledge goes), are not situated at altitudes much above 5000 feet. But there is one crater-lake which must be at an altitude of 8000 feet, and which is situated on the southern side of the Mubuko valley. This is the highest and nearest to the snow of any obvious evidence of former volcanic action which I have come across on Ruwenzori.* Although I am not a geologist, I am quite disposed to agree with Mr. Scott Elliot, who I think was the first to point out that, although Ruwenzori exhibits traces of volcanic activity on its outskirts, it is not, as a mountain range, of volcanic origin like Kenia or Kilimanjaro. On the eastern side of the mountain, and for aught I know on the western side likewise, permanent snow lies at the relatively low altitude of 13,000 feet. After heavy showers of rain in the lowlands, freshly fallen snow may be seen on the lower heights of Ruwenzori at 11,000 and 12,000 feet, but it does not lie very long; whereas snow lies in patches more or less permanently at 13,000 feet. The lowest point of the lowest glacier that we visited was 13,200 feet in altitude, but evidence of glacial action in the valleys extended 3000 feet lower. The thunderstorms which are of such frequent occurrence along the lower slopes of Ruwenzori, do not appear to mount higher than 9000 feet. Above that altitude rain falls finely—not in heavy drops—but every day. Rain often turns to hail, sleet, or snow at 13,000 feet.

From Bihunga, the last permanent habitation of man in the Mubuko valley (the exact altitude of which was 6858 feet),† we ascended along a native path to a camping-place underneath a huge rock at the head of the left branch of the Mubuko valley. The altitude here by boiling-point was 9762 feet.‡ This was the first of the extraordinary series of rock-shelters which served as camping-places to Europeans and natives ascending the mountain by means of the Mubuko valley. The camping-places consist of small areas of absolutely dry soil under an over-reaching cliff of micaceous rock. Two yards, 3 yards, 4 yards away from the

* I have visited two of the seven or eight hot springs found on the lower slopes of Ruwenzori, between 6000 and 4000 feet.

† Water boiled at 200°·1 Fahr.; temperature, 58°.

‡ Water boiled at 195°·1 Fahr.; temperature, 52°.

shelter of the overhanging ledge the ground is an impossible bog. Immediately under the arch it is bone-dry. However convenient, I doubt if there is permanent safety under these rock-shelters, since it would seem as though from time to time fragments of micaceous rocks detached themselves from the overhanging roof. In this way these cliffs are probably crumbling away by degrees at their base, infiltration of water from the bogs above no doubt being the cause. From this second camp, which was called by the natives Kichuchu, we had a most

UPPER MUBUKO GLACIER, RUWENZORI, WHICH DESCENDS TO 13,100 FEET.

arduous climb, sometimes dragging our bodies up the bed of a small torrent, and being nearly drowned in the process. For miles we walked, as I have already said, along slippery tree-trunks, often unable to see through the crevices any solid ground beneath us. At length we reached the edge of the upper valley of the Mubuko river, and found for a couple of miles or more a charming tract of flat country like a beautiful swampy garden. Here, too, we found the largest of these rock-camps under huge, overhanging cliffs. This other camp was called

by the natives Buamba, which really means "up above," "*the* height" *par excellence.* The altitude of Buamba camp was 11,447 feet.* The next day we climbed for a little under two hours, and reached the last of the rock-shelters at an altitude of about 12,500 feet. From or near here we obtained suddenly a splendid view of the snows of Ruwenzori. Looking up the main Mubuko valley, we saw a fine panorama of snow-fields and glaciers; but westwards appeared to be the highest point of Ruwenzori, a huge black knob rising out of the snowfields of unruffled purity and dazzling white. From the last of the rock-shelters we directed our steps towards where the ascent of the snow-range seemed most practicable, namely, the Mubuko glacier. The altitude of the base of this glacier was 13,191 feet.† We found it was impossible to climb higher in this direction without more elaborate preparations than we had made in the way of ropes and axes, so we returned for a while to Buamba camp to rest and botanize. Next day, instead of attempting the ascent by way of the Mubuko glacier, we probably followed the same route as Mr. Moore, and tried to ascend the mountain more or less midway between the Mubuko glacier and the highest peak, the peak which the natives call Kiyanja. In this way, after difficulties of the most exhausting nature and in the middle of a snowstorm, we reached an altitude of 14,828 feet,‡ and here we were obliged to stop. My two European companions (Mr. Doggett and my English servant Vale) were fairly exhausted with the cold, and perhaps with a touch of mountain sickness. Still more serious, our native Bakonjo guides and our Swahili porters were positively ill with the cold, in spite of our having clothed them in warm jerseys, coats, and blankets. The condition of some of the natives, in fact, was so bad that I am sorry to say one of them eventually died of pneumonia, and all were so ill that I dared not stop any longer at this altitude under such inclement conditions. We therefore returned once more to camp. The next attempt we made at an ascent was again in the direction of the Mubuko glacier. We were confronted here by a wall of rock about 7 feet in height, which at first seemed difficult to ascend, until the idea occurred to me of using my very tall Sudanese orderly as a human ladder. Mr. Doggett mounted on his shoulders, and managed to scramble over the ledge above. He then fastened a rope on boulders, and we each dragged ourselves up. After this we had to pass through a natural tunnel in the rock, which had been bored by a stream flowing from the glacier. As the tunnel was partly filled up by the stream in question, which was icy cold, this passage was very disagreeable. By one means or another we reached an altitude of 13,534 feet § on this glacier, and here our further progress

* Water boiled at 192°·2 Fahr.; temperature, 47°.

† Water boiled at 189°·3 Fahr.; temperature, 47°.

‡ Water boiled at 186·6° Fahr.; temperature, 40°.

§ Water boiled at 188°·5 Fahr.; temperature, 37°.

was barred by walls of ice at least 50 feet in height, and absolutely precipitous. We did a good deal of photographing here, but on our descent, Mr. Doggett became so ill from the cold and the wetting with the icy water that we were obliged to return to our permanent camp. The next day I made another abortive attempt to ascend the mountain, but illness was beginning to tell on all my companions, black and white, and I was afraid, if I did not descend to a warmer climate, there would be no one but myself left to tell the tale. Pneumonia seemed to afflict many of the men, and the disease made such rapid progress that the patient was almost beyond recovery before attempts could be made to arrest the malady. In this way we lost the best of our native guides,

ICE CAVERN, MUBUKO GLACIER.

to my very great regret, and two of our Swahili porters. For myself, I can only say that the short stay amid the ice and snow of Ruwenzori seemed to do my health as much good as if I had been to England. I had had a very severe attack of hæmaturic fever in Uganda before starting for Ruwenzori, but my visit to the mountain completely restored me to health and vigour.

The whole time of our stay on Ruwenzori the weather was, with very few and brief exceptions, atrocious. It rained constantly, and at high altitudes it snowed and hailed. The arrival of clouds had about it something positively alarming to our black followers and to the two Europeans accompanying me, who had had no previous experience in mountaineering. The clouds would come rushing up the Mubuko

valley like express trains one after the other, and they did not appear as vague mists, but as bodies of singular definiteness of outline which constantly seized and involved you as in a thick blanket. You might be sitting for a few minutes in brilliant, welcome sunshine, looking at the blazing white snowfields and the minutest detail of the rocks and boulders. Suddenly an awful greyish-white mass would come rushing at you, and everything would be blotted out. Even your companions 4 or 5 yards off were scarcely visible. Although I told myself there was no danger in this, the effect on the spirits was singularly depressing and alarming, especially as this occurred in dangerous bits of climbing. Sometimes a thick bank of cloud would enfold you for a quarter of an hour.

On neither side of the flanks of Ruwenzori, except perhaps on the extreme north-west corner, do the tropical forests quite attain the same extravagant development of vegetation as the never-to-be-forgotten Congo or Uganda forests. This Congo forest, which Stanley first made known to the world, has an appearance and aspect of its own which it is very difficult to describe. This type of forest, besides extending right away to the West Coast of Africa, reappears in a long strip at some distance to the east of Ruwenzori, running almost north and south from Unyoro into Ankole, and being continued with a few breaks through the western part of Unyoro more or less parallel with the east coast of the Albert Nyanza. This forest is obviously of the same character in flora and fauna as that of the Congo. It possesses chimpanzees, and most of its prominent mammals and birds are West African in type. On the western flanks of Ruwenzori, except at the north-west corner, although there is dense forest where the mountain begins to rise from the undulating plains, there is no sign of tropical luxuriance. On the contrary, from the base of Ruwenzori on the west to the Semliki river and beyond it is more or less open grassland, dotted with thorn trees and a few borassus palms. This grassland appears to extend right across the upper half of the Semliki to the lofty mountains which separate the watershed of the Semliki Nile from that of the Congo, and which encircle the western side of Albert Edward Nyanza. About halfway down its course, however, the Semliki suddenly enters a remarkable prolongation of the Congo forest, which, as it were, flows over this mountain range in a great black stream of dense woodland, and just touches the north-western corner of Ruwenzori. In this Semliki forest (which is absolutely continuous with the Congo forest), there are Pygmies, and there also exists that remarkable ruminant, the Okapi.

The negro tribes which inhabit the flanks of Ruwenzori are the Ba-konjo, the Ba-nande, the Ba-amba, and the Ba-toro. The Ba-toro are the same as the Ba-nyoro; that is to say, they are a mixture of more or less average Negroes and of that quite superior race the Ba-hima,

a race in origin the same as the Gala, the Somali, and perhaps the mainstock from which the ancient Egyptian sprang. The Ba-konjo inhabit the slopes of the mountain range in its southern half, that is to say, from the northern shores of Albert Edward Nyanza and the heights of the Congo watershed right round the southern end of Ruwenzori to the vicinity of Lake Dweru on the east. In appearance the Ba-konjo are rather a pleasing race, not offering any very distinct signs of Hamitic blood, but rather a well-developed, comely race of purely Negro stock. They are interesting more especially from the fact that they speak a Bantu language which approaches nearer than any, except perhaps one, to the form of the original Bantu mother-tongue. The only dialect which I have met with which is even more archaic is the Lugesu, spoken on the west side of Mount Elgon. It is, however, rather a moot question in my mind at present which is the more archaic in form, the tongue of the Ba-konjo, or that of the Ba-gesu of west Elgon. The Ba-konjo are a great deal mixed up with the Ba-nande, so that very often a Mu-nande classes himself as a Mu-konjo. The main distinction between seems to be that the Ba-nande are the people of the plains of the Semliki valley and of the border of the Congo forest, while the Ba-konjo are the mountain people of Ruwenzori and the heights to the west of Albert Edward Nyanza. The Ba-nande seem to be a race of pariahs, living on the outskirts of stronger tribes, and speaking the language of the tribe with whom they dwell. They are obviously the same as that ape-like people seen by Messrs. Grogan and Sharpe in the vicinity of Albert Edward Nyanza. I was certainly struck with the very low type of their heads. But this simian type of Negro crops up in many other parts of Africa, though the strain may be more obvious in this long-isolated district. The Ba-amba are not a race of particularly low appearance, though their stumpy legs deprive their figures of that well-proportioned appearance characteristic of the Ba-konjo. The Bantu dialect spoken by the Ba-amba is of the greatest interest in guessing at the origin of this remarkable family of languages, but it would be perhaps fatiguing if I commenced a dissertation on it here. Though thoroughly Bantu, it is absolutely unlike Lu-konjo, while Lu-konjo, on the other hand, is closely allied to the languages of Unyoro, Uganda, and Kavirondo. Although the Ba-konjo and Ba-amba tribes meet on the flanks of Ruwenzori, if their origins were in any way connected with the languages they speak, they must have followed widely different lines of migration before they met at this point of Africa.

Before the reading of the paper, the PRESIDENT said: It is now just seven years since we had the great pleasure of welcoming our old friend and associate Sir Harry Johnston in this hall, and of listening to his graphic account of his Nyasa government. We again have the pleasure of giving him a welcome on his

return from Uganda, and I will delay no longer in requesting him to address the meeting.

After the reading of the paper, the following discussion took place:—

Sir H. M. STANLEY: I have come wholly unprepared to say a single word to-night, and as it is a very late hour, I think that will be a legitimate excuse for me to be as brief as possible. With regard to what Sir Harry Johnston has said, I am sure I can have nothing to say but what is highly complimentary. It is twelve years now since I left that region of which he has shown a number of photographs, and I have been wishing and hoping and praying that some sensible man would go into Africa and explore that region of Ruwenzori thoroughly, so that something definite, something interesting, something of value would be found. Sir Harry Johnston has really surprised me by his beautiful photographs of Ruwenzori, and he only excites in me more the dear wish that some person devoted to his work, as Sir Harry Johnston has evidently been devoted to it, some lover of Alpine climbing, like Sir Martin Conway, for instance, would take Ruwenzori in hand and make a thorough work of it, explore it from top to bottom through all those enormous defiles and those deep gorges. Let him be a botanist, let him be a geologist, let him be a zoologist, but let him do his work thoroughly, and come back to the Geographical Society here, and let us all welcome him. Then as regards Sir Harry's allusions to the various languages of Africa, I will not say a single word, because I am afraid we should fall foul of one another upon one small portion of the discussion. I must say that, though I admire the photographs very much indeed, it seems to me Sir Harry has been unfortunate enough to pick out the ugliest dwarfs he could find in order to photograph them. There were one or two there who bore a faint resemblance to the Queen of the Pigmies that we found in the Central African forests. I am sure if we could have carried that little queen away and planted her here, it would be seen that she did not possess those lips, those distended nostrils and high back head which the photographs of Sir Harry have represented, and that these photographs were a libel on that beautiful little queen. With regard to all the rest, however, I can only consider that Sir Harry has done his work wonderfully well. It was said by a famous English orator that there was no acre in the wilds of Siberia, or on the shores of the Mississippi but when cultivated added something to the extent of civilization, and expanded the markets for British industry. How much might we not say with regard to Sir Harry, who can show what he has done in Lake Nyasa, in East Africa, and lately in Uganda? I am sure that all those countries are better, nobler, more aspiring since Sir Harry has been there, and I hope the Foreign Office will always have highly scientific, cultivated, amiable—even though they be a little cynical now and then—gentlemen like Sir Harry Johnston. And now let me voice the common feeling of this large and distinguished assembly here this evening, and let me, in their names as well as in my own, congratulate you, Sir Harry, upon your promotion to the Grand Cross of St. Michael and St. George. I hope there are other fields awaiting you, sir, and that before I die I shall see you with a still higher rank, as His Majesty Edward VII. knows well how to appreciate talent, administrative ability, and fidelity.

Mr. J. E. S. MOORE: If I may, as a fellow-traveller with Sir Harry Johnston in Central Africa, I should like to say a few words about the Ruwenzori mountains, which I had the opportunity of examining before Sir Harry Johnston's trip. It seems to me that Sir Harry Johnston has added materially to our knowledge of these mountains in every way; he has given us some magnificent photographs and some charming descriptions of the scenery which occurs there. But I should also like to point out that it seems to me Sir Harry Johnston is a little

unfortunate in having stated here and elsewhere (the *Graphic*) that he thinks that Ruwenzori is one mountain, and that it is the highest mountain in Africa, and also in his description of the way in which it was explored during recent years. Well, in regard to the first matter as to whether it is the highest, that is simply a question of opinion; we cannot, as Sir Henry Stanley has pointed out, at present say which is the highest portion of Ruwenzori, or what the height of several of the peaks may be; this may be 20,000 feet, or 40,000 feet, but nobody at present can say what height it is. All we know is that Sir Harry Johnston reached an altitude of 14,800 feet, and I reached an altitude, as far as I can tell, working it out carefully, of 14,900 feet, but we were not in the same place. Sir Harry Johnston pointed out, in the very beautiful view he gave, that the Mubuko glacier was the point I ascended. That was not so. There is a long snow-ridge which runs between that point and the broad glacier Sir Harry Johnston reached. Along this ridge there was a V-shaped rock, which I ascended, and it was on the top of this ridge that we reached our highest altitude. Of course at that time I was not, as Sir Harry Johnston has stated, with Mr. Fergusson at all; in fact, he went there some three weeks afterwards, and Mr. Bagge was some weeks after him. At the time I was quite alone with twenty men. I think Sir Harry Johnston has not drawn sufficient attention to the fact that Ruwenzori is by no means a single mountain. It is as absurd to speak of going up Ruwenzori in the singular as it is to speak of going up *the* Alp. Ruwenzori is an immense range, probably at least 80 miles long, and there are numerous peaks, and therefore it is quite impossible for any one to describe it correctly as a single mountain. As Sir Harry has pointed out, it is quite true that the so-called Saddle mountain is very rarely seen—unquestionably it is very high indeed, and I have a very strong impression, from the views I got, that it is a good deal higher than the others, but I have also a strong impression that even this mountain is not much over 16,000 feet.*

Dr. Bowdler Sharpe: At this late hour I do not feel that I can say very much about Sir Harry Johnston's zoological collection. It is a very important one, especially with regard to the discovery of the new animal, the Okapi. Dr. Christy, who has done a good deal of exploration on the Niger, tells me that on going up the Benue river, he heard of a strange animal being found in the forests. It may not be the Okapi itself, but it may be some animal like it, and as the forest is all part of the same West African system, so I think it is quite possible that we may find the okapi extending further to the west. Sir Harry discovered one of the most beautiful Turacos which it has been my lot to see for many a long day, and I dare say many of you have seen it, as it was exhibited for some time in the hall of the Natural History Museum. The Okapi is now in the Mammalian gallery, where you can see it. We are all indebted to Sir Harry, not only for his work, but for the wonderful collections he made during his Commissionership in Nyasa Land, and last of all for the very excellent collection he has made during his stay in Uganda,

* Mr. Moore must have misunderstood me. Perhaps almost more than any other traveller in these regions, I have insisted on Ruwenzori being a snowy range, and not a single snow-peak. More than a year ago I styled it the Caucasus of Central Africa. At the same time we must not exaggerate the length from north to south of the succession of snow-peaks and glaciers; this can scarcely exceed 30 miles. With the amount of snow and the extent of glaciation in this equatorial region, the maximum of 16,000 feet, suggested for the extreme altitude, is impossibly inadequate. Judging by eye alone (and I have seen the Alps and Himalaya), I should give a minimum of 20,000 feet for the highest point.—H. H. J.

which has been the more difficult as he has been travelling about, and that always makes it rather difficult to collect animals of any kind. But he has done what very few travellers do—he has collected a number of large birds, such as Vultures, Storks, and Eagles, such as we seldom get from the interior. So we have to congratulate him, not only on the work he has done in the past, but on the success of his present expedition.

The PRESIDENT: I feel sure that the meeting will agree with me that it will be very difficult to express our thanks adequately for the most instructive and interesting evening Sir Harry Johnston has given us, and for the series of pictures and his admirable commentaries upon them. I now propose a very cordial vote of thanks to Sir Harry Johnston, which I am sure will be carried unanimously.

APPENDIX I.

LIST OF PLANTS COLLECTED BY SIR HARRY JOHNSTON'S EXPEDITION ON RUWENZORI RANGE, 4500 TO 13,000 FEET.

Ranunculus pubescens, Thunb.
Nymphæa stellata, Willd.
Cardamine pratensis, L.
Arabis alpina, L.
Polygala near Fischeri, Gürke.
Hypericum lanceolatum, Lam.
Symphonia sp.
Hibiscus Grantii, Mast.
„ ?
Grewia mollis, Juss.
„ populifolia, Vahl, forma (G. membranacea, A. Rich.).
Geranium aculeolatum, Camb.
Impatiens Ehlersii, Schweinf.
Cardiospermum microcarpum, H.B. and K.
Bersama, cf. abyssinica, Fres. Flowers only.
Dolichos shuterioides, Baker.
Milletia sp.
Æschynomene sp.
Tephrosia dichroocarpa, Stend.
Parochetus communis, Ham.
Cynometra, probably new species.
Alchemilla, near A. argyrophylla, Oliv.
Rubus sp.
Kalanchoe, cf. glaucescens, Britten.
Combretum racemosum, P. Beauv.
Begonia sp.
Anthriscus, sp. nov. = Kilimanjaro, Johnston, 40.
Oldenlandia abyssinica, Hiern.
Pentas Ainsworthii, Scott-Elliot.
„ occidentalis, Benth. and Hook. f.
Visecta, cf. multiflora, Sm.
Mussænda erythrophylla, Schum. and Thonn.
Pentas, near verticillata, K. Schum.
Vernonia hymenolepis, A. Rich.
„ cf. Melleri, Oliv. and Hiern.
Gerbera Lasiopus, Baker.
Coreopsis Steppia, Steetz.
Helichrysum elegantissimum, Dl.
„ sp. Flowers only.
Senecio sp., near S. Johnstoni, Oliv.
„ sp.
Echinops, cf. giganteus, A. Rich.
Lobelia Giberroa, Hemsl.
„ Deckenii, Hemsl.
„ Stuhlmanni, Schweinf.
Erica arborea, L.?
Philippia, sp.
Asclepias macrantha, Hochst.
Belmontia grandis, E. Meyer.
Cynoglossum cœruleum, Hochst.
Solanum, sp. nov.
Hypoestes triflora, Roem. and Schultes.
Justicia pinguior, C. B. Clarke.
Streptocarpus caulescens, Vatke.
Lantana salviifolia, Jacq., var. ternifolia, Baker.
Premna sp.
Clerodendron myricoides, R. Br.
Celosia sp.

Fleurya æstuans, Gaud.
Synadenium sp.
Arthrosolen latifolius, Oliv.
Podocarpus sp.
Encephalartos sp. Leaflets only.
Eulophia sp.
„ milanjiana, Rendle.
Polystachya sp.
Angræcum sp.
Disa Stairsii, Kränzl.
Gladiolus quartinianus, A. Rich.
Asparagus africanus, Lam.
Chlorophytum blepharophyllum, Schweinf.
Scilla sp.
Gloriosa virescens, Lindl.
Bulbostylis trichobasis, var. uniseriata, C. B. Clarke.
Pycreus rehmannianus, C. B. Clarke?
Carex runssorensis, K. Schum.
Poa sp.
Imperata arundinacea, Cyr.
Olyra latifolia, L.
Davallia elegans, Sw.
Cheilanthes farinosa, Kaulf.
Pteris flabellata, Thunb.
Asplenium furcatum, Lam.
„ amœnum, C. H. Wright, sp. nov.
Asplenium rutæfolium, Mett.
Polypodium rigescens, Bory.
Lycopodium dacrydioides, Baker.
Breutelia Stuhlmannii, Broth.
Polytrichum sp. (barren).
Rhacocarpus Humboldtii (Spreng.).
Herberta juniperina, Spruce (Sendtnera juniperina, Nees).
Plagiochila sp. (barren).

APPENDIX II.

Notes on the Geology and Mineralogy of the Uganda Protectorate.

COLLECTION OF MINERAL SPECIMENS FROM UGANDA,

Made by Sir Harry Johnston, Messrs. George Wilson, Racey, Wm. Grant, C. W. Hobley, F. W. Isaac, and others.

The rock specimens include examples of the Archæan gneisses, schists, and granites, which constitute the main mass of the Uganda plateau: specimens of these rocks come from the Busoga, Bukedi, Elgon, and Unyoro districts, from Ruwenzori and the Nile province. Besides these basement rocks, there are specimens of ferruginous, schistose, and slaty rocks from Unyoro, possibly belonging to the Palæozoic Karagwe series; coarse ferruginous sandstones and quartzites from the shores of Lake Victoria Nyanza and Lake Naivasha, and from Ankole; and volcanic rocks (chiefly phonolites) from Kavirondo, Mount Elgon, Baringo district, Kamásia hills, Lake Nakuro, and the Nandi district.

Of minerals of economic value, the collection contains specimens of iron ore, graphite, and diatomaceous earth. The iron ore includes specimens of magnetite from Budolo hill, Masawa; Nagarive hill, Bukedi; and Jinja, Busoga: and of ironstone (limonite chiefly) from the Central province (Bukonge and Jinja, Busoga), Bugaya islands, Buvuma, Kavirondo, Ankole, and Unyoro. Graphite is present in small amount on specimens from Unyoro (Chief Byabaswezi), and the diatomaceous earth occurs 8 miles west of the Katonga river, and also on the shore of Lake Nakuro. As to the occurrence of gold, all that can be said is that no visible gold could be found upon any of the numerous specimens of quartz in the collection.

List of Specimens.

CENTRAL PROVINCE (BUSOGA AND BUKEDI).

Locality.	Name.
1. Budolo hill, Masawa.	Magnetite.
2. Bukedi country.	Decomposed mica schist.
3. Namjumbas, shore of Vict. Nyanza, Busoga	Grit.
4. Jinja, Busoga.	Hornblende-schist.
5. „ „	Mica-schist.
6. Nampirika Busoga.	Hornblende-schist.
7. „ „	„ „
8. Jinja Busoga.	Quartz.
9, 10. Bukonge, Lake Vict. Nyanza, Busoga.	Ironstone.
11. „ „ „ „	Quartzite.
12. „ „ „ „	Ferruginous sandstone.
13. „ „ „ „	Quartz.
14. Iganga, Busoga.	Quartz.
15. „ „	Pegmatite.
16. „ „	Epidosite.
17. Bugwen, „	Quartzite.
18. Kibui Busoga, shore of Lake Vict. Nyanza.	Diabase.
19. Iganga „	Gneiss.
20. Bukonge „	Ironstone.
21.	
22.	
23. Jinja, Busoga.	Laterite?
24. „ „	
25. „ „	Slate.
26. „ „	Hornblende-schist (decomposed).
27. „ „	Ironstone.
28. „ „	Epidiorite.
29. „ „	Decomposed hornblende-schist.
30. „ „	„ „ „
31. Jinja, Busoga.	Ironstone.
32. „ „	„
33. Nakalanga.	Quartz.
34. „	„
35–37. „	Sandstone.
38. Budolo hill (see No. 1), Bukedi.	Magnetite.
39. Lubusa hill, Bukedi.	„
40. Amuganda hill, „	Quartz.
41. Nabutitisi hill, „	Mica schist.
42. „	Gneiss.!
43. Mamjefe hill, „	Decomposed rock.
44. Namanswa hill, „	„ „
45. Asitosiro hill, „	Granite.
46. Madegi hill, „	Decomposed rock.
47. Sunurwa hill, „	„ „
48. Natere hill, „	„ „
49. Makakala hill, „	Quartz.
50. Wadubi „	Decomposed rock.
51. Bugagi hill, „	Large felspar crystal.

Locality.	Name.
52. Nagabu hill, Bukedi.	Decomposed rock.
53. Kumaga hill, "	" "
54. Bukyan "	" "
55. Nagarive hill, "	Magnetite.
56. Magmiti hill, "	Decomposed rock.
57. Nelubi hill, "	" "
58. Kumaga, Nasika "	Pegmatite.
59. Masige hill, "	Decomposed rock.
60. Musara hill, "	" "
63. Kyabala, "	Pegmatite.
64. "	Granite.
65. River Ntowolo "	"
66. Kuzaki hill, "	
66. Mulawa hill, "	Quartzite.
67. "	Pegmatite.
68. "	Gneiss.
69. "	Decomposed rock.
70. "	" "
71. Kadudamu hill, "	Gneiss.
72. "	Schist.
73. Kamurujo hill, "	Gneiss.
74. Nabare hill, "	Gneiss.
75. Kakani hill, "	Granite.
76. "	Tuff.
Jinja, Busoga.	Magnetite.
Lubas "	Quartz with mica.
Buconge, near Lubas, Busoga.	Ferruginous schist.
Callanga, Busoga.	" "

LAKE VICTORIA NYANZA.

Bugaya islands.	Quartz, ironstone, ferruginous sandstone, quartzite, claystone.
Near Kisubi (Entebbe peninsula).	Ferruginous sandstone.
Small island near Bagai, Buvuma.	Phyllite.
Main island, Bavuma.	Quartz with mica.
" "	Red ferruginous schist.
Entebbe.	Quartz.
Kampala.	"
Entebbe.	Clay.
"	Clay with muscovite.
Near Kisubi.	Ferruginous sandstone and quartzite.
Buvuma, Marabio island.	Ferruginous schist.
Bay between Sango and Kisubi.	" "
Between Kisubi and Kampala.	Sandstone.
Sango.	"
Tagana.	Quartzite.
Eight miles west of Katonga river.	Diatomaceous earth.

Kavirondo.

Locality.	Name.
Bed of Nyando river.	Nephelinite.
Bed of lower Kidonia river.	„
Upper waters of „	„
Southern slopes of Tindaret, Mount Kamililo country.	Phonolite.
Mount Manava, 12 miles west of Fort Ternan.	„
1. Awichina, 8 miles north of Kisumu.	Granite.
2. „ „ „	„
3. Korando hills, 4½ miles „	Phonolite.
4. „ 2 miles „	„
5. Kisumu, raised beach 1 mile from shore of Lake Victoria Nyanza.	Pisolitic ironstone.
6. Nyando valley, 10 miles west of Fort Ternan.	Limestone from concretionary blocks in alluvial deposits overlying granite and gneiss.
7. Nyando valley, 3 miles south of Kitotoo.	Limestone like No. 6.
8. Lake-shore, south of Port Victoria.	Decomposed schist.
9. „ „ „	„ „
10. Kisumu, three-quarters of a mile from lake.	Phonolite.
11. Mkindu river, Nyando valley, near cart-road from Kisumu to Fort Ternan.	Gneiss.
12. Kiblules or Stormy river, 10 miles west of Fort Ternan.	„
13. Upper Nyando valley, 1½ mile north of Mount Blackett.	Tuff.
14. Langors camp, 3 miles west of Mau summit.	Phonolitic trachyte.

Elgon District.

2. Mumia's, sub-district.		Basatl.
3. Nyifa	„	Quartz.
4. „	„	„
5. Tindi	„	Gneiss.
6. Tindi	„	„
7. Kabras	„	„
8. „	„	Quartz.
9. „	„	Diabase.
10. Marama	„	Gneiss.
11. „	„	Quartz.
12. Nzoia river	„	„
13. „	„	„
15. „	„	Gneiss.
17. Lusimo river,	„	
18. „	„	Decomposed granite rock.
19. Ketosh	„	Quartz.
20. „	„	Gneiss.
21. „	„	Basalt? weathered.
22. Kahamega	„	Gneiss.
24. Kihelelwa	„	Quartz.
25. „	„	„

Locality.	Name.
26. Mumia's, sub-district.	Quartz.
30. Nyala ,,	Gneiss.
31. Sio river, ,,	Gneiss ?
32. ,, ,,	Quartz.
33. ,, ,,	Gneiss.
35. Lego ,,	,,
36. ,, ,,	Quartz.
37. Samia hills.	Gneiss.
38. ,,	Granite.
39. ,,	Quartz.
40. ,,	,,

Mount Elgon.

7000 feet.	Augite crystals.
,,	Nephelinite ?
,,	,,
,,	Decomposed rock.
6000 feet.	Fossil wood.
8000 feet.	Augite in volcanic bomb ?
,,	Basalt ?

ANKOLE.

20.	Quartz, ironstone.
21.	Quartz.
22.	Granite.
23.	Quartz with tourmaline.
24.	Coarse sandstone.
26.	Oolitic ironstone.
27.	Quartz.
1 mile south-west of Kisasagap.	Ferruginous shale.

TORO.

25.	Mica-schist, hornblende-schist, and diorite ?

MAU DISTRICT AND NANDI DISTRICT.

Cliffs on north-west coast of Lake Nakuro.	Kenyte.
Hill facing Lake Nakura, south of railway station.	Tuff.
Hill north of railway station, Lake Nakuro.	Glassy lava (Kenyte).
Hill north-east and 5 miles from Lake Nakuro.	Scoria.
Shore of Lake Nakuro.	Diatomaceous earth.
Seget valley, Nandi district.	Phonolite.
Sigowet Hills, ,,	,,
,, ,,	,,
Bed of Seget river, Nandi district.	,,
Kamasia hills, below ravine.	Red jasper, quartz, chalcedon, calcite, and phonolite.
Baringo district, Eldoma ravine.	Basalt, scoria, and phonolite.
Lake Naivasha.	Obsidian tuff, sandstone.

UNYORO.

Chief Tibansamba.

Locality.	Name.
1, 2.	Ferruginous schist or phyllite.
3.	Limonite.
4–6.	Ferruginous schist.
7.	Decomposed rock.

Chief Mutwa.

8.	Gneiss?
9.	Felsite?
10.	Mica-schist.
11.	Gneiss?
12.	Dolerite?
13.	Gneiss.
14.	Pyroxene-granulite.
15.	Quartz.

Chief Byabaswezi.

16.	Junction of decomposed basalt? with schist.
17.	Quartzite.
18.	Quartz.
19.	"
20.	Schist.
21.	Decomposed rock.
22.	Arkose?
23.	Ferruginous schist.
24.	Lydite.
25.	Claystone.
26.	Quartzite.
27.	Ferruginous schist.
28.	" "
29.	" "
30.	" "
31.	" "

Chief Kiza.

32.	Schist.
33.	Arkose.
34.	Ferruginous schist.
35.	" "
36.	" "
37.	" "

Chief Byabaswezi.

38.	Quartz with graphite.
39.	Ferruginous-quartz-schist.

Chief Tibansamba.

40.	Decomposed gneiss.
41.	Ferruginous schist.

Chief Basigala.

Locality.	Name.
42.	Limonite.
43–46.	Ferruginous schist.

Chief Katalikao.

47–50.	Limonite.

Chief Byabaswezi.

51.	Graphite in decomposed gneiss?
52.	Ferruginous breccia.
53.	Quartz.
54.	Ferruginous schist.

BARI, NILE PROVINCE.

Mount Belinian.	Gneiss.
Jibalokaju, north-west of Rejaf, left bank of Nile.	,,
Mount Lado, left bank of Nile.	,,
Twelve miles north of Bedden, right bank of Nile.	,,
Near Bedden.	,, and basalt.

SPECIMENS OF MINERALS AND ROCKS FROM RUWENZORI AND VICINITY, COLLECTED BY SIR HARRY JOHNSTON AND MR. R. RACEY.

List prepared by the Mineralogical Department, Natural History Museum.

SPECIMENS FROM RUWENZORI AND ANKOLE.

1 (237). Tourmaline and quartz from Charienzi.
2 (236). Iron wire made from ore found at Kahiro.
3 (235). Impure kaolin (mainly quartz) from Mbarara.
4. Quartz from Ruhihi Sema.
5. ,, ,, Mbiumbi, Egara.
6. ,, with mica from Kisenyi, Egara.
7. ,, from Chamianga, Ruzumburu.
8. ,, ,, Niamizi, Ruzumburu.
9. ,, with oxide of iron from Ngoma, Luchika.
10. Clay (decomposed schist) ,, 15 miles north-east of Mount Mfumbiro, Luchika.
11. Basalt, scoria, clay, quartz and ferruginous sandstone from mountain between Lake Chagasa and Mount Mfumbiro.
12. Quartz with mica from north end of Lake Kikombe.
13. Quartz with mica, quartz with oxide of iron, quartz grit with mica from 1° S., 29° 51′ E.
14. Tuff? from Kichwamba, Bunyaraguru.
15. Quartz with oxide of iron, decomposed mica-schist? from north of Kisara, in Bunyaraguru forest.
16. Quartz, quartzite, mica schist from Egara hills.
17. Hæmatite-schist, oxide of iron from Ebari.
18. Quartzite, ferruginous sandstone with mica from Nyakabingo, Bukanga.

SPECIMENS FROM RUWENZORI, ETC.

No.
224–234. from Kuti?
238–245. „ Ruwenzori.
224. Fibrolite.
225. Gneiss with chlorite.
226. Gneiss with pegmatite.
227. Gneiss.
228. Granite.
229. Tuff.
231. „
232. Gneiss with chlorite.
233. „ „
234. Gneiss.
235–237 = 3, 2, and 1 of first list.
238. Epidiorite.
239. „
240. Mica schist.
241. „
242. „
243. „
244. Quartz.
245. Epidiorite.

APPENDIX III.

UGANDA PROTECTORATE—ANALYSES OF SAMPLES OF WATER AND SALT FROM KIBERO SPRINGS, UNYORO.

The following report was obtained by the Crown Agents for the Colonies from Messrs. Stanger & Blount, Chemical Laboratory, 2, Broadway, Westminster.

The waters were slightly yellowish in colour, and contained a small amount of black sediment.

UNYORO. MINERAL SPRING NO. 1.

	Grains per gallon.
Silica (SiO_2) ...	3·64
Ferric oxide + alumina ($Fe_2O_3Al_2 + O_3$) ...	0·70
Lime (CaO) ...	6·44
Magnesia (MgO) ...	2·66
Soda (Na_2O) ...	155·82
Potash (K_2O) ...	20·23
Carbonic anhydride (CO_2) ...	0·42
Sulphuric anhydride (SO_3) ...	10·13
Chlorine ...	194·46
	394·50
Deduct oxygen equivalent to chlorine ...	43·82
	350·68
Combined water, organic matter, and loss ...	20·74
Total solids ...	371·42

The chief salts probably present are therefore—

	Grains per gallon.		Grains per gallon.
Sodium chloride ($NaCl$) ...	294·05	Magnesium sulphate ($MgSO_4$) ...	2·79
Potassium chloride (KCl) ...	32·07	Magnesium chloride ($MgCl_2$) ...	0·99
Calcium sulphate ($CaSO_4$) ...	15·64	Magnesium carbonate ($MgCO_3$) ...	0·80

The sample is a highly saline water, from which common salt could be easily prepared by evaporation. It also contains a noteworthy quantity of potassium salts, the recovery of which from the molten liquor might yield a valuable artificial manure.

UNYORO. MINERAL SPRING NO. 2.

	Grains per gallon.
Silica (SiO_2)	1·96
Ferric oxide + alumina ($Fe_2O_3 + Al_2O_3$)	0·56
Lime (CaO)	3·50
Magnesia (MgO)	1·26
Soda (Na_2O)	124·28
Potash (K_2O)	12·46
Carbonic anhydride (CO_2)	7·29
Sulphuric anhydride (SO_3)	7·00
Chlorine	140·42
	298·73
Deduct oxygen equivalent to chlorine	31·64
Total solids	267·09

The chief salts probably present are therefore—

	Grains per gallon.		Grains per gallon.
Sodium chloride ($NaCl$)	231·40	Magnesium carbonate ($MgCO_3$)	2·65
Sodium carbonate (Na_2CO_3)	2·82	Potassium carbonate (K_2CO_3)	6·22
Calcium carbonate ($CaCO_3$)	6·25	Potassium sulphate (KSO_4)	15·22

The water is generally similar to sample No. 1, and, like that, might be usefully worked for sodium chloride and potash.

SALT.

	Per cent.
Sodium chloride ($NaCl$)	87·67
Potassium chloride (KCl)	4·45
Potassium sulphate (K_2SO_4)	2·28
Calcium sulphate ($CaSO_4$)	1·68
Magnesium sulphate ($MgSO_4$)	0·24
Combined water, organic matter, and loss	3·68
	100·00

The sample is a crude grade of common salt, such as might be produced by evaporating water of the character of those analyzed above.

NOTE ON THE MAP OF UGANDA.—This map is based upon the map of Uganda, compiled at the Intelligence Division in 1899 from surveys of Colonel J. R. L. Macdonald, R.E., Major H. H. Austin, R.E., and Lieut. (now Major) R. T. Bright, R.E., corrected as regards the coasts of Victoria Nyanza by the surveys of Commander B. Whitehouse, R.N., with further corrections by Sir H. H. Johnston, Lieut.-Colonel J. Evatt, and Messrs. R. M. McAllister and C. W. Hobley. The Semliki river and Ruwenzori range, together with the boundaries, are taken from sketch-maps supplied by Sir H. H. Johnston. The Ankole district is in great measure from a sketch-map by Mr. R. R. Racey, also furnished by Sir H. H. Johnston; whilst the survey of Mr. M. Fergusson, of Mr. J. E. S. Moore's expedition, has served for the delineation of the northern shore of Albert Edward Nyanza. The new lake and the configuration of the region in the neighbourhood of the Elgeyo escarpment are from a prismatic compass sketch by Mr. F. W. Isaac; whilst the river system between Kavirondo bay and Lake Naivasha is principally from the map of Captain G. H. Gorges, published in the *Geographical Journal* for July, 1900.

CINEMATOGRAPHING THE SEVERN BORE.*

By VAUGHAN CORNISH, D.Sc. (Vict.), F.G.S., F.C.S., F.R.G.S.

At a meeting of this Society last session I showed some photographs recording the *form* of the Severn bore, but I wished to obtain a photographic record of its *motion*. This I have been enabled to do by the assistance of Mr. Charles Urban, managing director of the Warwick Trading Co., Ltd., who very kindly lent me a bioscope camera and the services of an operator for the purpose of cinematographing the bore. The photograph was taken under my direction on September 29, 1901, and was shown at the meeting of this Society on November 25. I believe this is the *first* cinematograph of a tidal bore.†

The cinematograph picture was taken at Stonebench below Gloucester, which is distant 4 miles by road reckoning from the cathedral. The tide was the third after full moon, and was not quite so high as that predicted for September 30, which was one of the four highest predicted tides of the year. After the dry summer the amount of land-water in the river was probably below the average, nevertheless the low-water level was 1½ foot above that given as summer low water in Admiral Beechey's survey made in 1849. The reason, no doubt, is that the spring tides had already begun to fill up the river. The camera was placed upon the left bank, as low down as was consistent with the safety of the instrument, and about 30 feet back from the submerged "Stonebench," so as to show the breaking of the wave where the water suddenly shallows from 6 or 7 to 2½ or 3 feet. A boat was engaged to meet the bore, and was anchored in deeper water at a suitable distance; and to obtain the scale a post near the left bank was measured, its top being found to be 58½ inches above low water.

The bore was heard at 9 a.m., a few seconds before its appearance round the bend of the river, at a distance of 513 yards from the camera. The resurgings from the concave left bank had a fine effect, well reproduced when the film is shown upon the screen The boat rode easily over the unbroken wave in about 10 feet of water. The height of the wave there I estimate at from 3 feet to 3 feet 6 inches,

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* Read at the Royal Geographical Society, November 25, 1901.

† The limelight hitherto in use at the Society's meetings not being adapted to show the picture advantageously, I was permitted to appeal to the Office of Works for a separate electrical installation with current of adequate power. The request was most kindly and promptly granted, and a permanent installation has been provided by the Electrical Department, which has not only met the requirements of the cinematograph, but will for the future enable the arc light, instead of the less pure and less brilliant limelight, to be employed for the optical lantern in the theatre at Burlington Gardens.

Fig. 1. Bore in the distance.

Fig. 3. Bore and its optical reflexion

Fig. 4. Bore breaking above the Stonebench.

and the height at the sides of the river 4 to 5 feet. At the jetty or breakwater, of which one post already referred to was visible beyond the osiers, the bore suddenly sent a sheet of water up to a height of 7 or 8 feet, but, recovering itself in a moment, the wave came on with a front still smooth and unbroken, its inverted image perfectly mirrored by the smooth water ahead of it. Then, on reaching the hidden Stone-bench, the wave curled over in a beautiful scroll (shown in Fig. 4). But no stationary photograph can reproduce the effect which is given on the screen as the dark-fronted curling wave rushes out of the picture, which is then immediately flooded with light, the bright clouds instead of muddy banks being now reflected by the smoother waters. The speed of the bore was about $13\frac{1}{2}$ statute miles per hour. The exposure of film was continued after the bore had passed in order to show the after-rush of water, the speed of which was well shown by floating *débris*. A boat happened to come by, one of the occupants of which was gathering in flotsam and jetsam, and the camera was then revolved so as to follow the boat as it passed. Owing to high osiers intercepting the view upstream, it was not practical to cinematograph the bore from behind, as had been intended. High water occurred fifty-six minutes after the passage of the bore, the total rise being 8 feet $6\frac{1}{4}$ inches. The height of the water then above ordnance datum was several feet higher than high water of even a 40-foot tide at Portishead. The current continued to flow up the river for thirty-one minutes after high water.

The tidal bore in nature is not precisely repeated at succeeding tides, and in most rivers is not seen at every tide. The cinematograph representation, on the contrary, can be repeated on the screen as often as required, and with a delay of only one or two minutes while the film is being re-wound. At each repetition the observer can concentrate his attention upon one particular feature. In this way I have seen several things on the picture which escaped my observation on September 29. Measurements can also be made from the film, either in the hand or from its projection on the screen.

I am now engaged upon a systematic investigation of the bore in the Severn, which I propose to extend to some other rivers, and I hope to present a paper upon the subject to this Society in about a year's time.

Description of the Plate.

(The figures are enlargements from individual pictures upon the cinematograph film.)

Fig. 1 shows the bore in the distance as a bright band, where immediately before had been the dark image of bank and trees. The 5-feet post is visible on the left, with its reflection below.

Fig. 2 shows the boat rising to the wave. The wave on the right of the boat

cuts into two the reflection of the trees on the right bank. A comparison with Fig. 1 shows at once the turbulence of the water behind the bore. The alternation of wide bright bands with narrow dark bands parallel to the front of the bore, indicates the character and position of the undulations behind it, whilst the confused reflection of light near the left bank indicates resurging therefrom. If the apparent heights of the banks in the two figures be measured, the level of the water will be found to have risen behind the bore.

Fig. 3 shows the wave as yet unbroken, but with steeper front due to its approach to the shoal; the inverted image is plainly visible. Measurement of the post from the picture shows that the water there is 2 feet 5 inches above the level of the river in front of the bore.

Fig. 4 shows the bore rushing over the Stonebench. The mean level of water at the post is 2 feet 11½ inches above low water, but there is a noticeable difference of level at front and back of the post, indicated by a dark shadow on the picture. This shows that the current, which, shortly before the bore arrived, I found to be ebbing seawards at 0·8 mile per hour, is now making in the opposite direction with considerable strength. The boat remains in position, being anchored.

THREE JOURNEYS IN NORTHERN OMAN.

By Rev. S. M. ZWEMER, D.D.

HISTORICALLY, politically, and geographically, Oman has always been the most isolated part of Arabia. As far as outside communication with other Arabs is concerned, Oman was for centuries past an island, with the sea on one side and the desert on the other. The people are even more primitive than Arabs in general. Only Maskat has its eyes open to the wide world; that is the only port in all Oman at which steamers call. Ottoman rule never extended to Oman, not even under Suleiman the Magnificent; nor did any of the earlier caliphs long exercise their authority here. The whole country has for centuries been under independent rulers, called imams or sultans. The population is wholly Arab and Mohammedan, and derived from two different stocks, the Kahtani and the Adnani—rival races ever at feud or war with each other. The Jebel Akhdar region, or southern Oman, has been explored in part by Wellsted, Miles, Carter, and others. Northern Oman and the so-called Pirate coast are less known. It was my privilege, while engaged in missionary labour, to visit this region on three journeys. The first was in May, 1900, when I crossed from Sharka, on the Persian gulf, to Shinas and Sohar, on the Gulf of Oman, by way of Wadi Hitta. Afterwards, in February, 1901, I travelled along the Pirate coast, from Abu Thabi to Sharka; and the last journey, in May, 1901, was right across the north of Oman, from Abu Thabi to Sohar by way of Bereimi. All of these journeys were made with one companion only, a native of Mesopotamia; and we were of necessity compelled to travel with as little baggage as possible, since we knew not how the Wahabi Arabs would receive strangers and Christians. Instead of giving a diary of

each journey, I will combine the results and information gathered on the way into one account.

The only way to reach the Pirate coast is by native boat. On my last journey, we were eleven men in a small boat without cabin and only a narrow sailcloth for awning; a fine Arab horse and a yelping greyhound, presents from the Bahrein sheikh to the Sheikh of Abu Thabi, also took passage. The noble quadruped had the largest share of accommodation midships, and the dog was confined to the forecastle lest prayers be polluted. We had a corner on the left side of the poop; the captain, with a *mullah* and a merchant, squatted at our right; and

UNDER A VILLAGE MANGO TREE IN OMAN.

the crew slept, smoked, washed themselves, and ate their dried fish and rice anywhere.

We passed the islands of Karnein, Arzenah, and Dalma, but did not land. From the latter island I secured some fine specimens of iron-ore crystals and iron oxide. Dalma is a great centre for the pearl-boats during the season, and one of the principal markets in the gulf. Merchants from the Arabian and the Persian coast meet here to secure bargains in pearls, and competition is often very keen.

Abu Thabi is the first town on the so-called Pirate coast, and was settled some hundred years ago by the great Beni Yas tribe. The town is under an independent ruler, Sheikh Zeid, and his influence is wide and strong over all the tribe inland as far as Jebel Akhdar. The sheikh is a well-preserved old man; although his years are over

threescore, he has twelve sons, and the full number of wives that the Moslem law allows. We found him genial, hospitable, and, for an Arab, very intelligent. We were assigned to a large room in one of his stone-built houses, and all our wants were supplied from his beneficence. Huge dishes piled with rice, steeped in gravy, and crowned with several pounds of prime roast mutton, the whole surrounded with dates and bread-loaves on a large mat, and washed down with perfumed water! We were never hungry in Oman; everywhere this hospitality was repeated.

The population of Abu Thabi is not over 10,000, and, except a dozen Banyans from Sind, is wholly Arab or Negro. With the exception of a dozen houses and an imposing castle, the whole town is built of date-mats, and extends along the seashore for nearly 2 miles. The only industries of the town and of all the coast are pearl-fishing and drying fish for export. On Ptolemy's map of Arabia this region is named *Ichthiophagoi*; and Niebuhr wrote, "Fishes are so plentiful on the coast, and so easily caught as to be used not only for feeding cows, asses, and other domestic animals, but even as manure for fields." His testimony is true.

About 80 miles north-east of Abu Thabi is the real metropolis of northern Oman, the growing town of Debai. In the 'Persian Gulf Pilot' (edition 1890) the population of this town is given at 5,000; it is at least three times as large now. Between Abu Thabi and Debai the coast is desert, and so flat that a hill 220 feet high is called Jebel Ali (the high mountain). This is the only landmark on the coast, and visible 17 miles. The town of Debai has many good houses built of native stone, and plastered on the outside; the harbour is an inlet, or *khor*, and the town is built on both sides of this, so that ferry-boats ply between continually, and the place has a business-like aspect quite unusual in Arab towns. At the present rate of growth, Debai will outstrip all the other towns, and soon be a port of call for steamers. At present all the cargo for this region is landed at Linga, and re-shipped in native craft.

Sharka is still a Wahabi centre, although this Moslem sect has lost a great deal of its old fanaticism. The people of Debai, however, consider their neighbours heretics, and make sport of a rival bazaar where tobacco is still sold *secretly*.

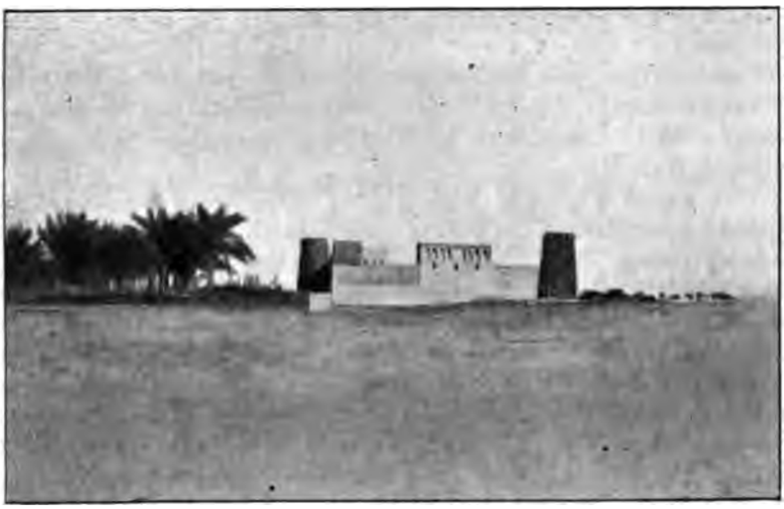
Formerly this entire region was noted for the savage ferocity of its inhabitants. Forty years ago Sir John Malcolm wrote, "Their occupation is piracy, and their delight murder; they are monsters." Thanks to British trade and influence in the Persian gulf, these fanatic Wahabis have become tamed, and they have settled down in many places to begin agriculture. Young date-plantations are a sign of the progress of civilization, and commerce is crowding the nomad spirit out.

From Sharka the coast continues flat and sandy until you reach

Ras-el-Kheima; Ajman and Um-el-Gawein are unimportant hamlets. The low coast which is characteristic of all the Arabian littoral from Kuweit down the gulf, ceases here and gives place to rugged headlands:

> "O'er the sea
> Of Oman beetling awefully;
> A last and solitary link
> Of those stupendous chains that reach
> From the broad Caspian's ready brink,
> Down winding to the green sea-beach."

Jebel el Harim, the chief peak of these headlands, is 4470 feet high, precipitons and rugged, as are most of the peaks on Ruus-el-Jebal.



THE CASTLE AT ABU THABI.

Ras-el-Kheima, the largest of the northern towns, was identified by Bochart and Sprenger as the Raamah of Scripture (Gen. x. 7, Ezek. xxvii. 22), while the Greek geographers speak of it as Regma Polis. There are said to be ancient inscriptions on the rocks in the region back of the harbour, but I did not visit the spot. There is coffee-house babble in Eastern Oman concerning a mysterious race of light-complexioned people who live somewhere in the mountains, shun strangers, and speak a language of their own. I think I have found the clue to this strange story that has puzzled travellers to Maskat. At Khasab, near Ras Musandam, live a tribe whose speech is neither Persian, Arabic, nor Baluchi, but resembles the Himyaritic dialect of the Mahras described by Carter (*Journal Bombay R.A. Soc.*, July, 1847). This language is used by them in talking to each other, although they speak Arabic with strangers. Their complexion is, however, like that of the

average Arab, and their religion Islam. Perhaps this is the tribe the rumours refer to.

In my journey from Sharka across the north of Oman, we rode on camels. For the sum of twenty *rials*, or Maria Theresa dollars (the standard of value among all the nomad Arabs), we secured two companions and five camels to take us to Sohar. By travelling in the cool of the day or by starlight, and resting at noon under some scraggy acacia or in the shade of a Beduin fort, we completed the distance of ninety odd miles in a little over four days. At first the road is bare desert of white sand without pasturage, and therefore without even the booths of the nomads. But on the second day we passed villages and cultivated fields. The three chief hamlets are Felaj, Fulaij, and Athan. On this slope of the Zahira hills there is good pasture and plenty of water. One night we slept in a wadi-bed, surrounded by thousands of sheep and goats, driven in by Beduin lasses from their pastures. The ascent to the wadi-passes that lead to the coast is gradual, the descent more abrupt. As the usual route by Wadi Hom was said to be unsafe, we followed Wadi Hitta.

Our guides proceeded mounted, but with their rifles loaded and cocked; then followed the baggage-camel, to which mine was "towed" in Arab fashion by hitching the bridle of the one to the tail of the other; in like manner, my companion rode his beast fastened to the milch-camel, followed by its *two* colts. We were not troubled by the heat at night, but during the day it was intense, and it was refreshing to come to an oasis where water burst from a big spring, and trees and flowers grew in luxury. In these mountain passes of Oman the roads run almost invariably along the wadi-beds; sometimes these are sandy watercourses with huge boulders, again deep rocky ravines or broad fertile valleys. Vegetation is fairly abundant. Tamerisks, oleanders, euphorbias, and acacias are the most common trees and shrubs. Where the country appears arid and sterile, one is surprised to find a considerable population of shepherds and goatherds. Their dwellings are mere oval shanties constructed of boulders or rocks; the *tent* is rarely seen in Oman, and is rather characteristic of North Arabia than of the south. In the fertile valleys the population always centres in villages, and scarcely ever is a dwelling found at any distance from this common centre. Here often are the fresh-water wells and the watch-tower that protects them in case of war.

Just at the top of the pass of Hitta is the village of Ajeeb, rightly named "wonderful." The view 1000 feet down the mountain and over the fertile stretch of coast called El Batina out to the Indian ocean was grand. We descended to the sea, and the turbulent mountain stream, so cold to our bare feet as we waded it in the early dawn, dwindled to a brook, and at last ebbed away along the beach, a tiny stream of fresh water. These perennial streams are the secret of the

fertile coast all the way from Wadi Hom to Birka, a distance of 160 miles. From Shinas, where Wadi Hitta reaches the sea, we rode along the coast past El Wa (wrongly given as Lawa on some maps) and other smaller villages to Sohar; thence by boat to Maskat.

Our last journey also terminated at Sohar, but we came across country from Abu Thabi by way of Bereimi and Wadi el Jazi. On the way to Oman I visited the island of Keis, on the Persian coast, about 40 miles west of Linga. The population is mostly Arab, and is now confined to three villages, Sefil, Harira, and Mashi. Date-groves abound,

OMAN CHILDREN IN FEAST-DAY DRESS.

and the water-supply is good. Keis is a very ancient settlement, and has ruins to witness to its former importance. When the trade of Ormuz flourished, Keis rivalled its neighbouring city of Siraf.

The town of Abu Thabi is situated on an island at high tide, as the backwater of its harbour turns in a few miles beyond the settlement, and forms a channel 200 yards wide, and, even at low water, 5 feet deep. This natural barrier against nomads from the desert has been utilized. Right in the midst of the tidal current stands a fort, built by the predecessors of Sheik Zeid. Even without its challenge, ordinary camels

with their riders have a close escape from drowning every time they cross. Our animals were in up to the breast, and had there been a slip or a stumble we should have come to grief. Along a sand-beach, level as a billiard-table, we rode out from Abu Thabi 10 miles to this ferry, which the Arabs call *El Maktaa*. The water was too high on our arrival, so we slept on the bank until the tide was lower, and the Arab watchman in the fort signalled that crossing was safe. The route we took to Bereimi runs due east for three camel-hours, to a place called Hisn Iblis, the Devil's Castle, an outcrop of limestone rock in fantastic shape above the white sand. For two days beyond, the road is through sandy stretches with scarcely any vegetation. Shale and shingle crop out at intervals, everywhere with a dip of 30° to the north.

We travelled with as little baggage as possible, to avoid awakening cupidity on the part of any Arabs we might meet—only four camels in the caravan, and all our belongings in two Bagdad-leather boxes. At noon we rested under the shade of blankets stretched over our boxes; there was no vegetation large enough for shade. It was over 104° Fahr. in the shade one day, and the water in the skins took on a foreign taste after hours of jerking on the camels. On our halts we made soup from condensed vegetables, and had dates for dessert. But the Beduins of our party were afraid of tinned provisions; they much preferred boiled lizards and rice. There are two species of lizard in Eastern Arabia—one is called *dabb* (*Uromastir acanthinurus*), and feeds only on desert vegetation; the other is called *waral* (*Weranus arenarius*), and eats insects, birds' eggs, etc. The latter kind is considered forbidden, but the former lawful food.

The only settlement we passed on the way to Bereimi was Nachshila, a half-ruined village with a few date-trees. By camel-marches and ordinary caravan rate of 3 miles an hour, it is thirty-three hours from Abu Thabi to Bereimi, and thirty-seven from there to Sohar. Water is scarce on the route, but camel-grass and tamarisk shrubs are plentiful when you pass the Ramlah el Kebira, or "the great sand-heaps." This is a long range of sand-mounds shifting with the desert winds, and about 100 feet in height. Dews fell very heavy at night in May, and it was remarkably cold, so much so that we needed camp-fires at daylight on one occasion. On Sunday, May 5, we arrived at an encampment of the Muzari Arabs, and spent the day with them. Their tents were like those of the northern nomads, but smaller and more wretched. These were the only tents we saw in Oman. We left our Beduin host at nine o'clock that evening, and rode until past midnight in the bright moonlight, always due east. In the early morning we came across a poor nomad lass, who had lost herself in seeking for a strayed camel. Our guide gave her water and dates, and helped her on the way to her tribe, the Beni Awamer. All around was a wide wilderness of

sand, not level, but in weird folds and billows that change with every simoon storm. In one narrow pass, between two high sand-heaps, we heard "the song of the sands." A fairly strong wind swept along the upper layer, and its vibrations gave forth two distinct notes, with volume and tone as sweet as a church-organ. The day was hot and dry.

At noon in the camp our Arabs sprinkled the saddle-ropes of the camels —like Chinese laundrymen are said to sprinkle clothes—by squirting them with their mouth full of water. They said it was the only way to keep them from breaking in this intense dry heat, which cracks everything. On Tuesday we reached the oasis of Bereimi, a 4-mile

stretch of fertile palm-country under the shadow of Jebel Hafid, the first spur of the Okdat range. It seems, after careful inquiry from several Arabs, that the true name, or at least a second name, for this mountain range is Jebel Okabat. The first name signifies "knots," the latter "deep defiles;" both names are appropriate to the rugged outline of the range, as seen from the desert.

Bereimi is the name applied to a group of villages in this oasis, viz. Geemi, El Kantara, Oheli, Ain, Saara, and Matrid. These villages are nestled in one continuous fertile strip of garden—palms, fig-trees, mangoes, mulberry-trees, and pomegranates. On the outskirts of the gardens is a plain, green with grass and shrubs, where sheep and camel-herds tell of Arab wealth. The oasis is due to a half-dozen springs of excellent water from the Okdat range, bubbling up out of the rocks, and led in artificial channels to irrigate as wide a region as possible. Bereimi was formerly called Et-Towam (twins), and the ancient name of the district, the Arabs said, was El Ghabir. The entire region from Jebel Okdat and Jebel Akhdar, north-west to the coast, is called by the Arabs *Ez-Zahira*, in opposition to the eastern coast, which is called *El Batina*, terms which are best translated by "the outer" and "the inner" region. On the road from Bereimi north to Sharka there are twenty hamlets of the Beni Kaab tribe; this, too, is a regular caravan-route. Wellsted did not reach Bereimi, and Palgrave's information is inaccurate, as he wrote from hearsay. Bereimi was for many centuries the most important centre of western Oman. In 1736 the Persians, under Saif-bin Sultan, took the castle of Towam, after utterly defeating the forces of Imam of Maskat in a battle fought near Es-Samini. About the year 1800 (A.H. 1214) the Wahabis entered Oman, and their leader, El Harik, a Nubian slave, took up his residence at Bereimi, and levied tribute for his master, Abd-ul-Aziz.* Although no longer under foreign rule, Bereimi is still a Wahabi centre, but the people are very friendly, and have put off the austere garment of Arab Puritanism, although retaining its ritual in their mosques. The towns of this oasis have no special industries; the gardens are well kept, and all the labour is done by slaves, who form, I think, at least one-half of the population.

Beyond Bereimi, the road along the Jebel Okdat range passes the following villages: Hafid, Senana, El Felai, Dank (or Danj), Jabil, Subaihi, Mamur Abri; Jebel Hafid is two camel-hours (*i.e.* 6 or 7 miles) from Bereimi, and thence to Oki it is four days by caravan. By my pocket aneroid I made the height of Bereimi 1400 feet above sea-level. Jebel Hafid is probably about 2500 feet.

From Bereimi we went due east along the Wadi el Jazi route to Sohar. The villages we passed are marked on the map; there are

* See 'Badger's History of the Imams and Seyyids of Oman' (London, 1871), pp. 230 *seq.*

others at some distance on either side of our path, but I did not get their exact names. It is difficult to understand Arabic gutturals from the mouths of such utterly ignorant Beduins as were our companions. The principal tribes east of Bereimi are the Kenud, Majabil, Showamis, and Beni Haith. These Arabs, as well as those of Bereimi, do not acknowledge the authority of the Sultan of Maskat, but have their own chiefs, and are, alas! nearly always at feud with each other. Every peasant goes armed, and one does not pass even a greybeard riding a diminutive donkey without seeing a rifle, or at least a crooked dagger at his side. Yet, in spite of continual warfare, they cultivate every fertile spot assiduously, and raise all sorts of crops—barley, wheat, sesame, vegetables, and even tobacco. In one village we rested on the wide threshing-floor, where the old-fashioned "threshing instrument with sharp teeth" lay idle. The Oman plough is better than that of Mesopotamia, where they use a crooked stick with a sharp prong to cultivate the loamy soil. In this mountain region the law of the survival of the fittest has given the peasant skill in making a real coulter of iron, fitted to a heavy frame and braced with an upright handle of three bars set at right angles to the frame. The common name for plough is not *miflah*, but *hais*.

It took us exactly twelve hours on camels from Bereimi to Wasit; all the road was level except the last 10 miles, where the ascent of the pass begins. The real entrance to Wadi el Jazi is 6 miles beyond Wasit. All these mountain villages of Oman have great similarity: a cluster of stone-built huts around a larger mosque or sheikh's house, narrow paths between the cultivated terraces, and a background of palms overtopped by fine mango trees. The people are simple, friendly, and hospitable. The veil is absent, and the women enjoy unusual respect and liberty. Nearly all of them belong to the Abadhi sect (also called Biyadhi); this is one of the many Moslem sects that grew on the soil of Persian speculation. They have no special tenets, except that, generally, they are more lax in practice of the ritual and less rigid in conduct toward unbelievers. We were known as Christians, and yet they gave us the village mosque in which to treat the sick, preach, and pass the night!

From Bereimi to Wasit the vegetation of the desert is scarce; the only large shrubs are *mirh* and *ghaf;* in the wadi-bed there were several varieties of wild flowers, but not at all in such profusion as in Yemen. Beyond Wasit, however, the country is more fertile, and continues so all the way to the coast. I have never seen more luxuriant date trees and taller mangoes than at Ohi, just north of Sohar; the gardens were beautiful, and the road was for miles in the shadow of overhanging foliage.

From Wasit to Khan is three hours by camel; from Khan to Ohi fifteen. The latter part of the road is very trying both for beast and

rider; rough rocks, narrow defiles, and slippery boulders make the camel-saddle anything but easy for the traveller. We were quite worn-out when we came to Sohar, and had there been a fair wind, we should have taken our journey by sea to Maskat; but after trying it as far as Saham, we bargained again for camels, and rode the entire distance to Maskat along the Batina, 150 miles. This fertile province has been often visited by travellers, and needs no description by me. It may interest economical travellers to learn that the whole journey overland from Abu Thabi to Sohar and on to Maskat cost me and my companion only Rs.90.

BOLIVIA BY THE RIO DE LA PLATA ROUTE.

By Colonel GEORGE EARL CHURCH.

It seems an absurdity that a country lying on the Atlantic slope of South America should carry on nearly all of its exterior trade by the way of the Pacific ocean, yet such is the case with Bolivia. For three-fourths of a century, she has hoisted her products up the eastern side of the Andes to an immense height, lowered them to sea-level, and sent them to a market by the way of Panama or the Straits of Magellan—the nation meanwhile resting in soporiferous contemplation of the problem of gravitation.

As the result of the wrecking and abandonment of the enterprise which, with ample funds, was engaged in the opening of an Amazon route, by the river Madeira, for Bolivian commerce, the country has found itself despoiled by Chile of its little strip of desert sea-coast, with the ports of Cobija and Mejillones, and has thus become a completely mediterranean state; so that now the unintelligent boundary-lines given to Bolivia by General Bolivar threaten her autonomy more than ever. After the Madeira river route was abandoned, several futile attempts were made to prove that its advantages would be exceeded by connecting the valley of the Mayu-tata by railway with the Aquiry branch of the Purus affluent of the Amazon, an idea which explorations demonstrated to be of no value.

Now, the Government is turning its attention to the Paraguayan side of the country, and has just published, in Buenos Ayres, a work of considerable geographical importance called 'Exploraciones Practicadas en el Alto Paraguay y en la Laguna Gaiba, por el Capitan Enrique Bolland,' an English mercantile officer who, it is stated, has had extensive experience in navigating the rivers of the Plata basin, and who, in the employment of Bolivia, has recently made surveys and founded a port for that country on the Alto Paraguay.

Heretofore the efforts of Bolivia to establish a south-eastern outlet

have been feeble, and have depended principally upon the enterprise of private individuals. True, the reports on the character of the region to be traversed have not been encouraging, and Article II. of the Treaty of Limits of 1867, with Brazil, was so framed that it gave the latter country almost the entire upper Paraguay river from the Bahia Negra, 20° 10′ S. lat., leaving to Bolivia only the western *half* of the lakes Caceres, Mandiore, Gaiba, and Oberaba, which connect with the Paraguay by intricate and shallow channels. These *lagunas*, or lakes, aside from some of the drainage of the Chiquitos sierras, take part of the western overflow of the vast marshes of the Xarayes, which, in the rainy season, flood thousands of square miles, struggling to maintain the lacustrine condition which, in that region, followed the subsidence of the ancient Pampean sea.

Captain Bolland gives us some interesting geographical data in his report. The expedition left Puerto Suarez (lat. 18° 55′ 26″, and long., west of Greenwich, 57° 50′ 31″) on November 9, 1900, on the steamer *General Pando*, especially charted for the explorations. She was 70 feet long, 25 H.P., and drew a minimum of 3 feet of water. It took $3\frac{1}{2}$ hours to reach Curumbá, 11 miles up-stream, owing to the shallowness of the Bay of Caceres, the steamer finding it almost impassable without touching bottom. Two miles above the mouth of the San Lorenzo (or Cuyabá) river, the course of the Paraguay, suddenly changing direction, comes in from the west and leaves to the north some lagunas of little depth. and bays which extend to the front of the great laguna Oberaba. The river here is much narrower, but its depth continues to be the same. Just before reaching the outlet of the Gaiba laguna, they crossed a bar with but 9 feet of water, and then left the Paraguay to enter a branch which connects with the Gaiba. "This place is notable because the continuation of the Alto Paraguay seems to be simply a very narrow canal, half choked with aquatic plants, forming almost a right angle in its change of direction to the north; while, on the contrary, the arm, canal or true river, which opens into the Gaiba, is broad, clear, and runs directly from west to east. Upon some of the loose rocks which cover the shores are seen engravings, true hieroglyphics—the work, no doubt, of the Guatoes, or of ancient dwellers in this region."

"This section of the Alto Paraguay, so called between Curumba and the laguna Gaiba, has for the greater part of its serpentine course the same appearance as the Paraguay between Asuncion and Cúrumbá, sometimes running between low banks, swamps, and inundated areas covered with aquatic and tropical plants, and then again flowing between low hills or at the foot of a cliff, the rocky formation of which is covered with vegetable earth, upon which are generally shady forests. . . . In all this part of the Alto Paraguay, there are but three passes of little depth. The first, going up-stream, is the 'Rio Viejo,' which on November 18 had 9 feet depth of water; the second, 'Las tres Bocas,'

passed the same day, had 11 feet; and the last, that of the Gaiba, on November 20, had 8 feet; this being the least depth, the maximum in general being 50 feet. The section has no very quick bends, nor currents which exceed 3 miles an hour, nor are there aquatic plants which obstruct the channel. In *résumé*, this upper Paraguay river is completely, and at all seasons, navigable for steam-craft drawing up to 5 feet of water, the length of which does not exceed 65 metres (213 feet). It should be stated that these observations were made in November, 1900, and that, due to the configuration of these regions, it is possible, or, better said, probable, that both the channel of the river as well as the formation of its banks may vary. Speaking of low and inundated banks, any flood, be it casual or periodical, can cause the river to change its course and the character of its banks, and consequently of its channels, which is corroborated by the Paraguay and San Lorenzo, the channels of which have completely changed their direction in certain places since several years."

Captain Bolland, after penetrating the Gaiba, went north through the narrow caño or canal, 10 miles long, which he calls the Rio Pando, and which connects the Gaiba with the Oberaba laguna. He describes the canal as having, in general, low margins entirely subject to floods, and offering no solid foothold, except a part on the eastern side, where it runs along the base of some of the hills of Guato covered with loose stones, which slide into the river and form reefs. "The Oberaba is apparently much larger than the Gaiba, but its margins are entirely inundated at high water; and the lands which surround them, as far as the eye can see, are swamps covered with trees and aquatic shrubs, without a hill to the west as in the Gaiba. It was entirely free from *camalotes*, which is not surprising when its great area and the sea raised by any wind are considered, these impeding the formation of floating vegetation upon its low shores. The depth of the Oberaba at its entrance is 6 feet, but this should increase as the centre of the lake is penetrated."

Returning from the Oberaba to the Gaiba, the little steamer grounded in mid-canal, and, at its Gaiba exit, scraped over a *tosca* reef for a distance of 65 feet. The finding of *tosca* at this point confirms the extent inland of the ancient Pampean sea. Some effort was made to pass through an apparently connecting caño between the Gaiba and the Gaiba Merim, a laguna estimated to be about 3 miles long and half a mile wide, and a short distance west of the Gaiba; but the canal was only 2 feet deep, and so choked with plants that it could not be navigated. In entering the Gaiba by the Rio Gaiba from the Paraguay, only 4 feet depth of water was found, but afterwards a careful examination resulted in the discovery of a channel having a minimum of 7 feet.

The Gaiba is, according to the map which accompanies Captain Holland's report, divided into a northern and southern section, the latter

occupying about two-thirds of the entire area of the lake, and being about 5 miles wide from east to west. The map shows the total length of the lake to be about 10 miles.

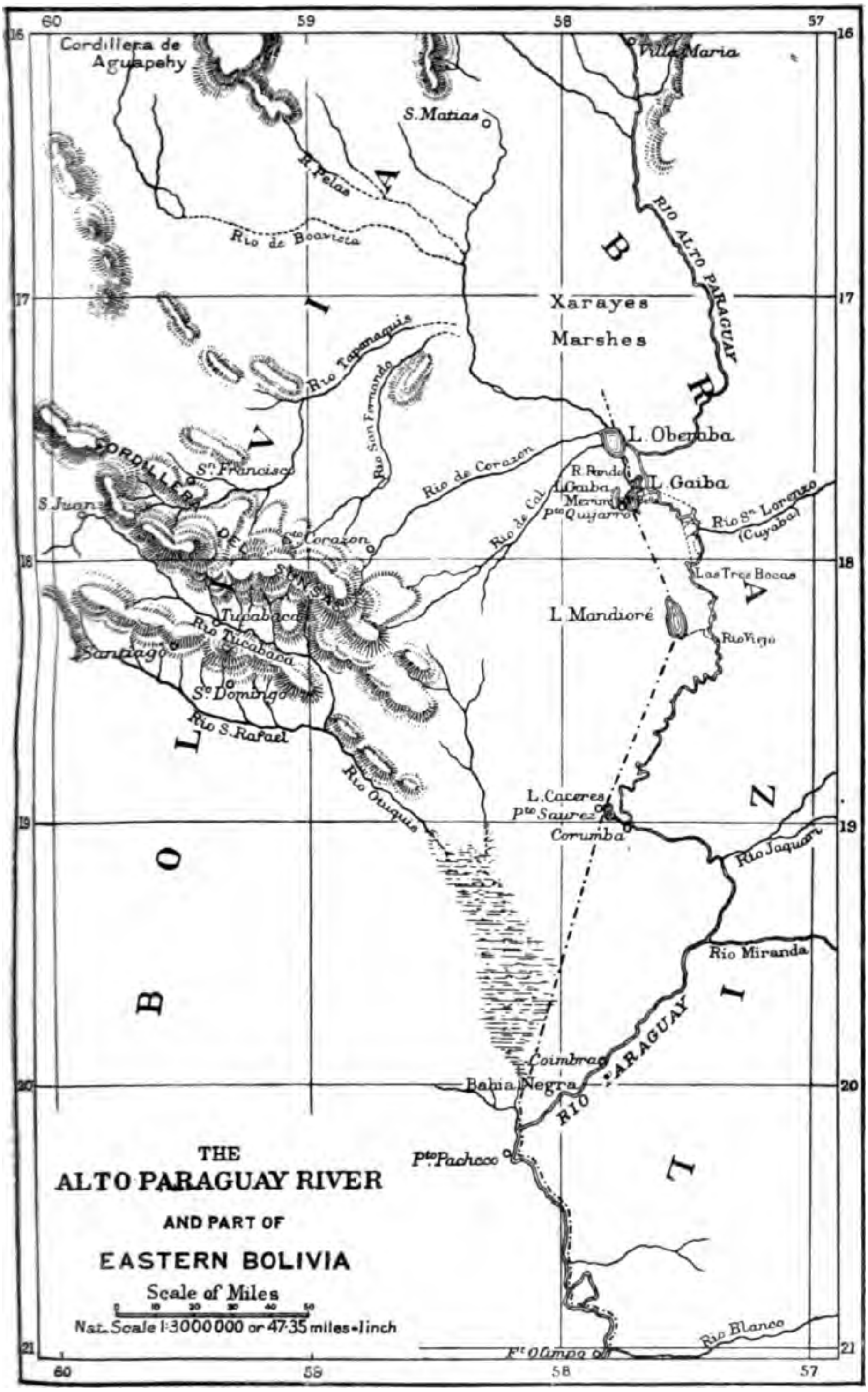
Captain Bolland selected a site for a town and port on the western or Bolivian shore of the southern part of the lake, and gave it the name of "Quijarro," in honour of the Bolivian minister to Paraguay. As the position is the same as that selected in 1543 by Martinez de Irala and named by him "Puerto de los Reyes," it would have been a graceful recognition of the merits of that *conquistador* had the port been called Irala. Captain Bolland says of the Gaiba, "The eye never tires of admiring this vast extension of water entirely surrounded by hills, some very high, covered with thick foliage. . . . Lake Gaiba is divided into two nearly equal parts by an imaginary line fixed by the International Commission of Limits between Bolivia and Brazil, but the northern part of the Gaiba is entirely in Brazil. . . . The maximum depth of the lake is 12 feet when its surface is 10¾ feet below the highest flood-line. This depth decreases as the shores are approached, until on the Bolivian side it is 5 feet deep, about 650 feet from the shore; while on the Brazilian side it is the latter depth at 100 feet from the margin. The Bolivian shore is low throughout, and, with the exception of the 'Bahia Quijarro,' subject to floods, much of it to a considerable distance inland. . . . The shore of Port Quijarro rises gradually for a distance of 75 feet from the water's edge up to 3½ feet above flood-line, and thence, for about two-thirds of a mile, slopes up at the rate of 5 feet per 1000 to the foot of Mount 'Bella,' which is about 300 feet high. All the southern coast is subject to inundations in high floods, and is covered with aquatic plants. A connection probably exists between the Gaiba and Lake Mandiore, but the caño is so choked with vegetation that it is impenetrable. The Gaiba Merim is surrounded by low hills, the nearest being about 1½ mile from the Gaiba. Through these hills must *perforce* be found the route to reach the centre of the Republic of Bolivia." The site of the proposed town is covered with a dense growth of tropical vegetation. The explorations were made in the early part of the rainy season, from November 21 to December 17, 1900. The Gaiba abounds in fish of many kinds, especially the *piraña*, or *palomita*. Among other insects, vast clouds of mosquitoes "constitute a regular plague." The temperature during the explorations was extremely variable, ranging from 21°·50 C. on December 7 to 40°·20 C. on December 12. The latitude of Port Quijarro is 17° 47′ 35″, and the longitude west of Greenwich is 57° 44′ 38″; magnetic variation, 4° 44′ E.; height above the sea, 558 feet; distance by river from Buenos Ayres, 1653 miles.

Among the conclusions drawn by Captain Bolland, "it is necessary to mention the great advantages offered by the Gaiba over other points of the Bolivian territory adjacent to the Alto Paraguay for the

establishment of a direct fluvial route between the European markets and the interior of Bolivia. Ascending the Alto Paraguay, the first point reached is the Bahia Negra, which would require dredging for any navigation before reaching solid ground, which is lower and subject to inundations in extraordinary floods. To communicate with the interior, it is requisite to find a track among overflowed areas, salt marshes, and useless barren lands, and the distance to Santa Cruz de la Sierra is 62 miles longer than that from the Gaiba. The next point up-stream is the Bay of Caceres (Puerto Suarez). Like the Bahia Negra, it is of little depth, and also requires important dredging, and this in Brazilian territory. The road to the interior, the only one existing, or which can exist, is intransitable for carts in one section during the rainy season; and it is in that epoch that the river is the highest, and consequently when vessels can most easily reach Puerto Suarez. From here to Santa Cruz de la Sierra the distance is 23 miles greater than from Gaiba." The next point is Gaiba, "the port of which can be reached without dredging. It is only necessary to establish the most direct communication with Santa Cruz by a road to San Ygnacio, the construction of which would be simple, as the country it would cross is almost level, with slight undulations, and, moreover, is high, dry, and free from floods, with fertile lands of the best class. True it is, the river distance is 280 miles greater than from Bahia Negra, and 140 miles more than from the Bay of Caceres. . . . Goods imported at the latter port have to be transhipped at Cúrumbá into small craft of light draft; thus to reach Puerto Suarez the cost is almost equal to the freight paid from Buenos Ayres to Cúrumbá. The goods for Santa Cruz de la Sierra have to be taken in carts or on mule-back 400 miles, when from the Gaiba the distance over fertile lands would be 379 miles."

"In my judgment, the laguna Gaiba is the only point of Bolivian territory upon the Alto Paraguay where a port can be established without great expense, which will permit the shipping of the valuable products of these rich regions on Bolivian steamboats and take them directly to an Argentine port."

"From Port Suarez to Santa Cruz, some merchants, at times, contract for transportation by mules or pack-saddle oxen, obliging the owners to sign an agreement to deliver the goods in forty days in consideration of a payment of 80 cents extra per *arroba* (25 lbs.). Owners of carts require five months to carry goods between the same points, but only when the road is very good; that is to say, when there have been no heavy rains, inundations, or excessive droughts. The worst feature is the scarcity of carriers, due to the great mortality of animals; and it is no rare sight to see goods remain at Puerto Suarez, six, eight, and even twelve months without finding any one to take them. Some merchants are making the experiments of sending goods by way of Salta and Yacuiba."



Cordillera de Aguapehy
S. Matias
R. Pelas
Rio de Boavista
Villa Maria
RIO ALTO PARAGUAY
Xarayes
Marshes
Rio Tapanaquis
Rio San Fernando
CORDILLERA DE SUNSAS
Sn Francisco
S. Juan
Rio de Corazon
Corazon
Rio de Cal
L. Oberaba
L. Gaiba
Pto Quijarro
Rio Sn Lorenzo (Cuyaba)
Las Tres Bocas
L. Mandioré
Rio Vigo
Tucabaca
Rio Tucabaca
Santiago
Sn Domingo
Rio S. Rafael
Rio Otuquis
L. Caceres
Pto Saurez
Corumba
Rio Jaquari
Rio Miranda
RIO PARAGUAY
Coimbra
Bahia Negra
Pto Pachoco
Rio Blanco
Ft Olimpo
BOLIVIA
BRAZIL
THE
ALTO PARAGUAY RIVER
AND PART OF
EASTERN BOLIVIA
Scale of Miles
Nat. Scale 1:3000000 or 47·35 miles = 1 inch

Such, in substance, is the report of Captain Bolland in his *brochure* of 144 pages (with accompanying maps) giving the results of the expedition; but half of the volume is from the able pen of his Excellency Dr. Antonio Quijarro, the Bolivian minister at Asuncion, who for very many years has vainly been trying to prove that the best trade outlet for his country is by the Paraguay and Plata rivers.

Captain Bolland is entitled to much praise for the new light he has thrown, not only upon an interesting region of South America, but perhaps upon its most important commercial and political problem. It is of such interest that it may not be considered inappropriate to give the experience and views of other explorers in the same field, and a little historical data regarding it.* Alexis Garcia, from Brazil, crossed the Chaco with a large expedition, and raided the frontier of the Inca empire before Pizarro landed in Perú. In 1537 Juan de Ayolas, Governor of Asuncion, undertook to open communications with Perú. He penetrated west from the bank of the river Paraguay at a point in lat. 21° S., which he named Candelaria, where in 1793 the Spaniards built "Fort Bourbon," now Fort Olimpo. He was massacred with his whole following by the Indians of the Gran Chaco. When Alvear Nuñez Cabaza de Vaca succeeded him as adelantado, he commissioned Domingo Martinez de Irala to realize the idea of Ayolas. Irala, therefore, left Asuncion in October, 1542, and on January 6, 1543, reached the laguna of Gaiba, founded the Puerto de los Reyes on its west side, and penetrated four days' march to the west. Cabeza de Vaca himself followed Irala in September, 1543, ascended the Paraguay river to the Gaiba, and entered Chiquitos, a distance of eighteen journeys. He then returned to Asuncion, was forcibly deposed, and was succeeded by Irala. This remarkable man prepared another expedition in 1548, with a view to penetrate Perú. Starting from the Gaiba, he reached the Guapay, or Rio Grande, which he crossed, and marched to the slopes of the Andes near the present site of Santa Cruz de la Sierra. He then sent his second in command, Nuflo de Chaves, with dispatches to the viceroy at Lima. Chaves returned to Asuncion by the way of Chuquisaca, and subsequently, in 1560, made another expedition, and founded the original settlement of Santa Cruz de la Sierra near the existing hamlet of San José. The position of Santa Cruz was afterwards changed to the west of the Rio Grande, at the base of the Andean foothills. It is notable that some of the settlers of the original town, instead of going to the new site when the removal took place, "built a boat, descended the Mamoré and afterwards the Marañon, and finished by reaching Cadiz" (see Azara).

Charlevoix, referring to the Gaiba and the Puerto de los Reyes, says, "Independently of the beauty of the locality and the softness of

* See Herrera, Oviedo y Valdez, Charlevoix, Azara.

the climate, there were many reasons, it appears, to cause the (Spanish) Government to fortify and place a garrison there. Nothing was more appropriate than to establish there a connection between Paraguay and Perú, which it had so much at heart."

Captain Bolland has, no doubt, demonstrated that Irala was right in fixing upon the Gaiba as the most accessible point of Bolivian territory upon the Alto Paraguay, whether from the sea or from the region of the Andes. But navigators of the upper Paraguay in general do not confirm the statement that the Gaiba can always be reached by steamers drawing 5 feet of water. I think, however, that 3 feet may be safely conceded, and this is enough so far as accessibility and commercial utility of the port are concerned. But there is an important factor upon which the report touches very lightly—the character of the country between the Gaiba and the Andean foothills.

Mr. J. B. Minchin, an accomplished engineer, was some years ago employed by the Bolivian Government to explore the northern margin of the Chaco. He says,* "A barren zone, comprising some 20,000 square miles of the northern Chaco, stretches from the Parapiti to the Bahia Negra, and presents an almost uninterrupted extent of low thorny scrub, with great scarcity of water."

It may be said that all attempts to find a practicable route across the Bolivian Chaco from the Paraguay river south of lat. 19° S. have been failures; and, according to the season, the traveller who attempts it may die of thirst or be drowned before he reaches the foothills of the Andes, 400 to 450 miles distant. Some years ago I met, at Santa Cruz de la Sierra, the agent of the Bolivian Consul at Buenos Aires, who had recently arrived, by the way of the Paraguay river, with a consignment of goods. He told me that the steamer was able to reach within only 5 leagues of Asuncion, or as far as Angostura, and then transhipped its freight to a smaller craft for Curumbá. The distance from there to Santa Cruz, 570 miles, he passed over in the rainy season, and found 120 miles of road near Santiago almost intransitable, being flooded and filled with swamps and mudholes. The remainder of the way was better, and supplied with food for man and beast. He thought that the 120 miles of bad road might be avoided by taking a different route. In the dry season, the entire 570 miles is as wanting in water as it is overflowing in the wet one, and oxen and beasts of burden frequently died of thirst in attempting the journey. This information was fully corroborated by the Consul-General of Brazil, who had also just made the same voyage.

Upon the ratification of the treaty of 1867 between Brazil and Bolivia, a demarcation committee was named. Bolivia selected Don Emeterio Villamil, a gentleman of extraordinary scientific and linguistic

* See *Proceedings* of the Royal Geographical Society, July, 1881.

acquirements, who honoured me with his friendship. From Rio de Janeiro, he wrote to his government, November 20, 1869, "Bahia Negra and its vicinity is regularly inundated for eight or nine months of the year; only 6 leagues to the south is to be found high and dry ground. From there throughout the great extent of the laguna of Caceres, the topographical demarcation is absolutely impracticable. In my route from San Rafael to San Matais, I travelled through a part of the low and flooded districts situated to the west of the Mandiore and the Gaiba and Oberaba. Even in the very dry season of July, I passed by swimming, or in hide boats, the rivers Peias, Bugres, and Santa Rita, aside from other minor streams. Said rivers are the discharging arteries or large courses of the inundations which extend to considerable distances on both sides of the river. During the rainy season, the whole of this is the continuation of the lakes Gaiba and Oberaba. They are therefore deserts and inaccessible districts impossible of demarcation by land, and valueless. To the south of Bahia Negra, or to the north, in the Oberaba, even though points might be found suitable for a port, they would be useless on account of the enormous distance, the difficulty to open and maintain roads, and the impossibility of traversing them during the extensive inundations of more than six months of the year."

There appears to be much diversity of opinion among explorers regarding the true condition of the region of the Alto Paraguay during the entire year. Olinden, in 1836, declared that the Otuquis river, which drains into the Bahia Negra from Bolivia, was navigable; and Captain Page, of the U.S. navy, whose extensive surveys of the Plata river system are well known, said he had no doubt of the navigability of the Otuquis. Minchin contradicts these statements, saying, "From its western or Bolivian side the Paraguay does not receive any tributaries of importance north of the Pilcomayo; I found that the river Otuquis, which was supposed to enter it at the Bahia Negra, does not in reality do so, becoming absorbed in lat. 19° 4′, long. 58° 15′, at a distance of some 50 miles from the river, and terminating in a series of swamps which dry up completely every year; indeed, this occurs to a greater or less extent with the other streams which descend from the Aguapehy mountains and the ranges of eastern Chiquitos, the greater part of them becoming absorbed or forming creeks on reaching the lowlands adjoining the river."

Among the Chiquitos sierras are the low ranges of San Juan, the Sunsas, San Lorenzo, Ipeas, and Chochis lying between 17° and 19° S. lat. Some of them overlook the Gran Chaco, and have a south-eastern drainage into the Paraguay. They form a part of the *divortium aquarum* between the Amazon and Plata basins, and are the connecting link between the orographic systems of the eastern and western sides of South America. The northern rain-bearing winds lose most of their burden when they

strike the slope of these sierras, so that when they reach the southern side facing the Chaco they have but little moisture left in comparison to the heavy contribution which they make to the waters of north-eastern Bolivia, which seek an outlet by the falls of the Madeira river. The Chaco lands are therefore very dry, and during the dry season become so baked that their slightly undulating surface offers opportunity for the formation of vast shallow lakes and marshes during the period of rains and floods.

Captain Bolland's report seems to be somewhat indefinite as to the question of inundations to the west of the Gaiba and Gaiba Merim. One may well believe that the whole district requires a more thorough scientific examination than it has thus far received before a sound judgment can be formed as to its natural conditions during the entire year. If the Gaiba can be reached from the west by carts throughout the rainy season as well as the dry one, it may be possible to make a useful commercial route from there to Santa Cruz de la Sierra. Minchin's map shows that the first 60 miles of country is slightly undulating, with forest and grass land. For the following 90 miles a road would skirt the northern base of the Sunsa range, and then strike for 36 miles across sandy pasture-lands covered with scattered brush; then 90 miles through rich pastures, and, in sequence, 60 miles through a dense dry forest, to be followed by the great marshes of the Rio Grande and the difficult crossing of that large, capricious stream included in the remaining section of 43 miles, which, in a total of 379 miles, will take the road from the Gaiba to Santa Cruz de la Sierra, a small town far removed from the active commercial centres of Bolivia. Ultimately the wonderful natural wealth of the heart of South America—Bolivia—must find its way, by the most direct and easiest routes, to the Atlantic ocean, a very large share of it by the Argentine railways, but the greater part by the Amazon river. The opening of the country must, from its geographical situation, be productive of political consequences of the first magnitude to South America.

A JOURNEY FROM FARAFRA TO SIWA, 1898.

By WILFRED JENNINGS-BRAMLY.*

MR. WILFRED JENNINGS-BRAMLY left Cairo on December 1, 1897, with the intention of proceeding to Farafra and Dakhel, and thence to cross the unexplored desert to the oasis of Kufra. Travelling by way of the Fayum, the Birket el Kerun, and the oases of Bahrieh and

* For an account of Mr. Bramly's former journey to Siwa, see *Geographical Journal* x., 1897, p. 597. Map, p. 120.

Farafra, he arrived at the Kasr of Dakhel on December 26. He there expected to meet a man who had been spoken of highly as a guide, but who turned out a complete failure. Neither did he succeed in obtaining definite information on the route he proposed to explore, for the Senusi are very reticent in giving geographical information. Mr. Bramly learnt, however, that the Senusi performed the journey between Dakhel and Kufra in twelve days, and that a Senusi sheikh whom he had met had actually departed by that route, although he had given out that he was going by way of Ain Dal. As this sheikh only took with him a supply of water to last for six days, he supposes that water is found halfway.

Having thus failed in Dakhel, Mr. Bramly returned to Farafra, and left that place on January 10, 1898, with only two camels, his servant, and a very useless guide named Murzuk. He pretended that it was his intention to return to Bahrieh by way of Ain el Wadi, but no sooner was he out of sight of the village than he turned to the north-west, for he really proposed to go in search of Nesla (of Rohlf's map), and thence to a district named Bahrain. He had been told by Murzuk that Dal was the real name of Nesla, and that this small oasis had been discovered by his grandfather when following the spoor of a gazelle which had been snared in a trap set at Elbaida. Some ten years ago Sidi Haled, a sheikh of the Senusi, had offered to buy the place, as conveniently situated on the road from Farafra to Jerubab, when Murzuk made him a free gift of it for "the good of his soul."

On that day Mr. Bramly passed through a cliff-bound gorge to a narrow plateau, beyond which he camped in an open plain. On the 11th he passed to the south of Elbaida (Lebeida), where there is a well of brackish water and camel fodder. This place is frequented by the people of Farafra in search of gazelles.

Before reaching Ain Dal on the 11th, he crossed a belt of dunes having their steep sides towards the north-west. Dal itself occupies a sandy mound. An abundant spring feeds a pool about 4 feet in diameter, and there are clumps of date-palms and much argul (*Alhagi mammiferum*). On a smaller mound about a mile from the spring there is a disused spring. Mr. Bramly discovered the remains of houses built of mud bricks. These ruins he considers to be of Roman origin. At Dal he met two men of Farafra engaged in setting a most ingenious snare for a fox, which they hoped to enjoy for their dinner.

On leaving Dal, Mr. Bramly crossed a country generally level and barren, and bounded to the west by the great Dunes which form the fringe of the Libyan "Sea of Sand." In the evening of the 15th, for the first time since he left Dal, he met with bushes, and was able to pick up some firewood. On the 16th, towards the close of the day, standing upon the brink of an escarpment, he looked down upon mighty dunes, which he likens to a "tremendous sea suddenly turned into

stone." Here and there the sand was pierced by isolated rocks. At the camp he discovered a fossil echinoderm and shells. Earlier in the day he had seen birds, from which he concluded that the district of Bahrain, with its two lakes, must be near.* On the 17th he descended into a broad valley, where a single tamarisk and a few bushes pointed to the proximity of water, and which, after rain has fallen, affords no doubt abundant fodder for camels.

A way up to the plateau was discovered only after a prolonged search. Crossing the plateau, Mr. Bramly, for the first time, met with well-defined wadis, sloping to the north-east. On the 18th he camped in the midst of sand-dunes. On the 19th he crossed the main road from Siwa to Bahrieh, and arrived at a well about 4 miles to the east of Zitun, to which place he proceeded on the following morning, January 20. The principal town of the oasis of Siwa lies about 12 miles further west. Mr. Bramly did not visit it, but started on his return journey on January 21, and reached Cairo by way of Gara Mogara and the Natron valley on February 2.

Mr. Bramly made a careful compass survey of the route from Farafra to Siwa, of which our map is a reduction. The distances up to January 16 were measured by a perambulator, and after that date estimated according to the time spent upon the journey. In following his route we have assumed a variation of the compass of 7° W., and started from Farafra as a fixed point.† Accepting the latitude of Zitun as laid down on the map of Dr. Rohlfs, the resulting over-estimate of the distances would amount to less than three per cent., whilst Siwa, which Rohlfs (or rather his companion Jordan) places in long. 25° 30′ E., would have to be shifted 7′ to the east, or to long. 25° 37′. Mr Bramly determined a number of latitudes, but the results are discordant, and we have preferred to adhere to his traverse survey, which seems to be deserving of confidence.

TOPOGRAPHIC SURVEYING.‡

By Colonel Sir T. H. HOLDICH, K.C.I.E., C.B.

THIS is a most useful work—one of the first, if not the very first, that deals clearly and comprehensively with all the various branches of the art which we call "topographical" and the Americans "topographic." It is an art which is very much better understood in America than in England. Within the narrow borders of a highly developed country

* In 1896, Mr. Bramly (*Geographical Journal*, vol. x. p. 607) saw "Bahrain with its date-palm forest stretching as far as the eye could reach" to the south of Araj.

† As determined by Mr. H. Beadnall of the Egyptian Survey Department.

‡ 'Topographic Surveying.' By H. M. Wilson, U.S. Geological Survey. Wiley & Sons, New York; Chapman & Hall, London.

like England there is no opportunity for the practice of those wider and, in some sense, looser methods of surveying which are avowedly essential to the mapping of the broad plains and wild stretches of rugged mountain land which form the distinguishing features of America. We must turn to our colonies—to Africa, Ceylon, Australia, and New Zealand—for a condition of land surface which is in any way analogous to that of America. And then we find that, cramped by Ordnance Survey traditions and hampered by the want of trained artists, the topographical aspect of surveying has been generally ignored and lost under the immediate pressure of demands for purely local estate surveys. English colonial surveyors (apart from Canadians) have apparently not yet learned that no amount of compiling and building up of the patchwork of local cadastral mapping will ever produce a topographical whole—that "mother map" (as Wilson calls it) from which all other maps should spring. So we cordially welcome the work of an experienced and highly trained topographical surveyor from across the seas, although we may not altogether agree with the details of the methods he advocates. He writes, of course, as an American for America, and not for India, Africa, or Australia, where, so far as the physical configuration of the land is concerned, we may expect to find as great a variety as exists in America, but where the conditions of labour, of opportunity in the field, and of map reproduction out of it, are all so essentially different that it would be idle to expect American methods to fit squarely in detail to our colonial requirements. In Wilson's book, for the first time, we believe, is exploratory and geographical surveying dealt with as a distinct branch of the general art of topography in supersession of the old "route" and "itinerary" methods. If a fault is to be found with this part of the subject, it is that the subdivision of the various classes of topographic art is based a little too much on the *object* of the survey rather than on the *method* employed. There is no radical distinction of method, for instance, required for the topography of a geographic, geologic, or military map. Wilson extends the geographic branch into scales as large as 1 mile = 1 inch (so long as a sketch-system of hachuring is adopted in lieu of the continuous line contour), which is beyond the limit which would be assigned by Indian surveyors; and thus practically classes it with geologic and military maps, of which this may be considered the standard scale. To all of them the same system of surveying is applicable, and they might all be classed as topographical. But he is right in maintaining that the difference between exploratory (or what *we* should term geographical) and topographical surveys is essential, for this difference involves both method and object. As he insists on a geodetic basis or "control" for the exploratory survey, it is as well to explain that "geodetic control" (in America) signifies any sort of triangulation which involves the use of the theodolite and is

subject to computation. About this part of his subject by no means the last word has been said by Wilson, for there are methods of obtaining the requisite basis or "control" for exploratory work to which no reference is made. The basis of the geographical surveys of America, as of all topography, is the plane-table. This, indeed, is the instrument *par excellence* which, in the hands of a skilled American surveyor, is made to accomplish most for the art of topography. It is even largely used for purposes of triangulation as well as for traversing through forest country, and for contouring the rolling plains. It is in America (as it is in Russia) an instrument which may be termed universal. But not only in the many methods of using the plane-table, but in the art of adjusting those methods to the scale, and in balancing the relations between scale and control (*i.e.* triangulation), have we much to learn from Wilson's suggestive book. The practical application of the "continuous line contour" to the delineation of ground, and the use of the stadia, the spirit-level, and the range-finder as adjuncts to the plane-table, are all useful subjects of study to those surveyors who seriously contemplate the enormous expanse of mapping awaiting them in our colonies, the greater part of which must first of all be tackled on geographical methods, then be partially reduced to exact topography, and finally fall into the hands of the cadastral surveyor. One of the great lessons taught by Wilson is that cadastral surveys come at the *end*, not at the beginning, of those various surveying processes—geodetic, geographic, topographic, and revenue—which all gradually developing and civilized countries in the world have had to undergo.

The illustrations to the work are excellent specimens of the clear and readable nature of American map-printing, which undoubtedly owes much to the colour system of delineation and to the method of line contouring. Where a departure from this recognized method occurs (as, for instance, in Fig. 19, where the vertical system of hachuring has been applied to an exploratory survey) the result is not quite so satisfactory, although the same system represented in Fig. 25 is as effectual as could be desired, and proves that the American topographical artist is a master of his trade. Another commendable feature of the work is the introduction of the tables in context with the explanation of those processes which demand their use. Such tables are usually lumped together in the appendix. Here they come in most usefully in illustration of the text, and are consequently handy for reference. From them we learn (amongst other things) that the cost of American topographical surveys is, on the whole, about the same as that incurred for surveys on similar scales in India, in spite of the extra levelling operations which their system of topographical delineation requires. This is apparently due to economy of labour. But with the larger scales (say 4 inches = 1 mile and upwards) the expenditure increases

in America to three or four times that of Indian surveys. The expenditure in Great Britain over Ordnance Surveys of every class is so largely in excess of that of American or Indian that there must be a want of solid grounds for comparison. This is probably owing to the absolute difference in system: the plane-table is never used in England for Ordnance Survey work. An excellent chapter will be found on photo-topography, which is all the more valuable because it is in America only that the system has had a really fair trial. The author's opinion on this subject is to be found on p. 295: "In the average atmospheric conditions met with in the United States, the topographer will accomplish as much in one day with the plane-table as with the camera, while the resulting map will be decidedly superior;" but under peculiar conditions of cloud and mist, the camera may be useful in procuring a rapid record which would be impossible with the plane-table. American spelling occasionally startles our British conventional ideas throughout the book, and it is hardly consistent. For instance, the common technical word "plot" is sometimes written "pl*a*t" and sometimes "pl*o*t," and one wonders whether these are two words bearing different meanings, or whether they are one and the same. But this is hyper-criticism when applied to such a work as Wilson's. It is by far the best exposition of the "topographic" art which has yet appeared in the English (or American) language, and, taken in conjunction with Colonel Laussedat's admirable treatise on the history of the same subject, it marks, let us hope, a new era in that history—a clear recognition of the exact nature of the relations which exist between topography and geography.

MAP PROJECTIONS.*

Although only consisting of about forty pages, this little pamphlet contains much valuable information on the subject of Map Projections, as well as many useful and practical suggestions as to their relative merits, and the most suitable projections to be employed under various conditions and circumstances. Major Close has evidently made a thorough study of the subject, and has taken advantage of the mathematical investigations of others, especially the article on Mathematical Geography by Colonel A. R. Clarke, C.B., F.R.S., in the 'Encyclopædia Britannica,' and the 'Traité des Projections des Cartes Géographiques,' by A. Germain. The first of these he very properly describes as "by

* 'A Sketch of the Subject of Map Projections.' By Major C. F. Close, C.M.G., R.E., 1901. London: Printed for H. M. Stationery Office, by Harrison & Sons, St. Martin's Lane

far the most important discussion of the question in English," and continually refers to it.

Notwithstanding the fact that Major Close has drawn largely on previous writers, it would be a great mistake to regard his pamphlet merely as a compilation, for indeed it is far more than this, and contains, in a few pages, much that cannot fail to be extremely useful, both to the practical surveyor and geographical draughtsman. The former will find what he might look for in vain in many more pretentious works—some useful and practical hints on the projections most suitable for plane-table surveying and field work, whilst the latter should profit considerably by what the author has to say about projections in general, A glance at many of our atlases will make it clear to any one who is at all acquainted with map projections, that this subject has not received sufficient attention from those responsible for their reproduction, for although it is, of course, impossible to represent the curved surface of the Earth on a flat plane without distortion of some kind, yet by a judicious selection of the projection to be employed, much can be done to minimize the errors. It is not, however, in atlases alone that a lack of judgment is often displayed in the question of projection, and there are cases where large and important maps have been drawn on most unsuitable projections, such as the well-known French Government map of Africa, on the scale of 1 : 2,000,000, referred to by Major Close. If, instead of the orthographic, a more suitable projection had been employed, such as Colonel Clarke's Minimum Error Perspective projection, there would have been much less distortion in the outer sheets of the map.

After a few preliminary remarks, and a note on Field Projections, Major Close gives a list of the thirty principal projections, which he has arranged under seven different headings according to certain characteristics which they have in common; these are as follows: Orthomorphic, Equal-area, Perspective, Zenithal, Conical, Cylindrical, and Conventional. It is, however, very properly pointed out that "these terms do not strictly represent classes of projections, as they are not all mutually exclusive," but it is a very fair arrangement on the whole, and where necessary, cross references have been made. After this come some very sensible remarks under the heading "Choice of Projections," and a list of the projections used for some important maps. In the second part of the pamphlet the author describes briefly the thirty projections he has selected, in the order in which they appear on the list previously given. The descriptions are extremely short—too short, in fact, in many cases—but nothing more than a sketch of the subject has been attempted. However, it is doubtful if more than two-thirds of the projections mentioned possess sufficient advantages to make them worthy of serious consideration for practical purposes, and if the author had reduced the number, and given the space thus gained

to the fuller treatment of those projections that are really serviceable, he would doubtless have rendered his little book of greater practical value than it is at present. He might then, without increasing the bulk, have given fuller information, and added other useful tables and diagrams.

Much confusion has hitherto existed concerning the names and designation of many projections, and Major Close draws attention to this, and suggests that the matter should be settled by those whose judgment may be considered final and conclusive. He also points out, what is doubtless the case, that a really good and exhaustive text-book on Map Projections in English is much needed, and suggests that one should be prepared, based upon Germain's work and Colonel Clarke's article, to which he refers. There are one or two misprints, but they are so apparent that the reader is not very likely to be misled by them.

REVIEWS.

POLAR.

Dr. Nathorst in Spitsbergen and Greenland.*

In the summer of 1898, Prof. Nathorst organized an expedition in the well-known whaler *Antarctic* to explore the König Karl islands. Favoured by an unusually mild summer, he was able, not only to thoroughly accomplish his principal object, but also to sail round Spitsbergen, keeping a sharp look-out for floats set adrift by Andrée, or other indications of his fate, and to make a number of scientific observations and collections of all kinds.

Many of his most important geographical discoveries have been already described in these pages—the survey of Bear island, as well as its fuller examination by J. G. Andersson in the following year, and the survey of König Karl Land. The chapter on the history of the group appeared in *Ymer*, and a translation was published in the *Geographical Journal*, July—December, 1899. We cannot refrain from making a few remarks on Prof. Nathorst's rejection of the claims of Edge to be the discoverer of these islands. It is hardly necessary to point out that the words in 'Purchas his Pilgrimes,' "as farre to the northwards as seuentie nine degrees," will not bear the interpretation that Prof. Nathorst puts upon them. If, again, this interpretation were correct, and Edge had revised the map, surely the coast-line would have been drawn up to 79° instead of to about 78½°. Prof. Nathorst's suggestion that Edge was misled by an optical illusion is rendered doubtful by the fact that a Hull whaler, following Edge, also sighted Wiche's Land and named it Discovery. Still more untenable is the suggestion that Wiche's Land was the east coast of the Storfjord explored by Edge in the previous year, for that Edge himself was the discoverer of Wiche's Land must be evident to every one who reads attentively the whole passage in 'Purchas his Pilgrimes' down to the visit to Bell sound, in spite of the change of person referred to by Sir C. Markham.

* 'Två Somrar i Norra Ishafvet.' Af A. G. Nathorst. 2 vols. Stockholm: Beijers Bokförlagsaktiebolag, N.D. Pp. xxxv. + 352 and + xiv. 414. Three maps and numerous illustrations.

The expedition also determined the extent of White island, probably identical with Gillis Land, visited Karl XII.'s island, which proved to be little more than 300 feet high, examined and mapped Van Mijen's and Van Keulen's bays in Bell sound, and demonstrated the non-existence of the Swedish Deep, west of Spitsbergen, besides adding considerably to the scientific knowledge of the archipelago by observations and the collection of plants, animals, fossils, etc., including plankton from depths down to 1150 fathoms.

Several experienced arctic explorers having expressed an opinion that Andrée might have found his way to the north-east coast of Greenland, Prof. Nathorst set sail again in 1899, and, after examining Jan Mayen, steered his course towards Greenland. He made land at Shannon island, and thence sailed southwards till he came to Kaiser Franz Josef fjord, which he explored to its furthest extremity. He found that it became narrower towards the upper end, instead of expanding as shown on the Austrian maps, and that it did not extend as far into the land as there represented. Petermann's peak cannot be more than 9200 feet high. A large channel, opening out of the southern side and extending to Davy's sound, was explored and named Konung Oscar's fjord, while an island formed by branches of the fiord was named after this society. Here also observations and collections were made, and every chapter contains interesting notices on geology, animal-life, ice-phenomena, and other subjects. Prof. Nathorst refers to the past events in the annals of discovery relating to each place he has visited, and compares the experience of other naturalists with his own, thus rendering his descriptions more complete. Incidents of life on board ship and on shore do not occupy too much space, but serve to brighten the narrative. It is a very enjoyable book, and is illustrated by a large number of views, sketch-maps, etc., some of which are beautiful, not only from the grandeur of the scenery they depict, but also as specimens of photography.

CONFERENCE ON THE TEACHING OF GEOGRAPHY.

On Friday, November 22, 1901, a conference was held on the teaching of geography, at the offices of the London School Board, at which many of the teachers under the Board were present and took part. The chairman, the Rev. J. Scott Lidgett, vice-chairman of the School Management Committee, explained that this was one of the series of conferences of teachers organized by the Board.

Dr. Herbertson, of Oxford, began by pointing out that all parts of geography were not equally profitable in education, and that the problem of selecting the most educative was not an easy one. To attempt to do this by drawing up a detailed syllabus to be applied to all parts of the country was worse than useless. The course followed in any school should depend on (1) the geography of the district around it, and (2) on the interests of the teacher. While detailed syllabuses were to be condemned, there was no reason why the principles on which a syllabus should be drawn up should not be outlined. In any course in geography, the principles of the science, the world-distributions, and the home region should all have a place, and, in addition, a detailed knowledge of a selected continent or country. He then emphasized the need of studying world-distributions and the value of classifying the world into natural regions.

Miss J. B. Reynolds, B.A., who recently took the University diploma in geography at Oxford, pointed out that the teacher had to consider what his aims were in teaching geography, and by what methods he could best realize them. The aims

were—(1) to gain information; (2) to develop the mind; (3) patriotic. The first lessons should be geographical object lessons, rather than solely plan and map making. Open-air lessons were especially valuable even in cities, and were not as common as they might be; while better maps, models, and pictures were desirable. The geographer dealt with the ordinary rather than with the exceptional landscape; with the whole rather than with the details. Map-work should include map-reading as well as map-copying. The art of selection was the most valuable a teacher could cultivate. She suggested, (1) the teachers should be given clear ideas of the educational possibilities of geography, and attempt to realize them; (2) a liberal supply of maps, slides, and pictures was essential; (3) school excursions should be organized; (4) examiners should be urged not to lay less stress on knowledge of facts apart from general intelligence; (5) students in training colleges should have an opportunity for studying the best methods of teaching the subject.

Mr. Gee, of Hackney Pupil Teachers' Centre, said that to the definition of geography as a description of the Earth was due the respect of age. When it was considered as the science of the Earth, as the home of man, it raises enthusiasm which no other subject could. Physiography was the basis of geography, which had a natural science and a human aspect which should be co-ordinated. Talks with scholars were more important than lectures; and vivid word-painting and bold maps swiftly drawn were essential in good teaching. Pupils should construct their own definitions. Latitudes were best expressed in sun height, longitude in time units. The geography of the unexpected should be utilized; one of his best lessons was on two locust-beans, surreptitiously nibbled by a boy in class. The teacher should beware of being limited by political conventionalities, *e.g.* the Franco-Belgian region should be taught as a whole.

Mr. Barnes, Haig Street School, warned the teacher against trusting too much to the knowledge he had picked up in working for examinations. The kindergarten should be used for the introduction to geography; object lessons were of great value; railway guides suggested lessons, and great voyages such as that of the *Ophir* or of the *Discovery*. The boys should be encouraged to ask questions. Lantern illustrations were important, but children were apt to look at minor details, and the teacher must be clear what he wished his pupils to observe, and see that they did observe it. He outlined some of the methods of making slides and models, the latter with brown-paper pulp on the ordinary slates. He gave some details of a geographical circle organized by the teachers of the Hackney district. (Particulars of these will be found in the February number of the *Geographical Teacher*.)

Mr. Graham Wallas, chairman of the School Management Committee, said that his committee were desirous of seeing geographical circles formed similar to those at Hackney, and that they would supply slides, models, maps, reference libraries, etc., to such circles. He urged the teachers to apply for the *Geographical Teacher*, which had been put on the requisition list. He also asked schools to apply for permission to arrange for whole-day excursions in spring, and suggested that to different boys and girls different duties might be assigned—the collection of stones, plants, insects, artificial products, the taking of photographs, distance judging, and political geography as illustrated by notices on church doors, etc.

Mr. A. M. Davis, B.SC., suggested Hyde Park as a place for studying river-features, and Primrose Hill for contours. Old Roman roads and other highways might be traced, and parish boundaries, thus combining history and geography.

Mr. Dyke disliked the combination system, and emphasized the importance of the personality of the teacher.

Other speakers pointed out the value of the docks for geography lessons, of letters from friends abroad; while others discussed the question of whether there should be one teacher to give geography lessons to all classes, or to be responsible for other subjects in addition. The necessity of giving geography a more real basis on which true knowledge can be built up was emphasized by one teacher, who said that one moment on a mountain-top was worth ten thousand in the fœtid air of a classroom. Mr. Thorn, who has been studying French schools during the past year, pointed out how composition was taught in the geography class, and that history and geography were taught by one master, who gave more time to the preparation of lessons than our teachers, and emphasized the manners and customs of peoples in his lessons. Mr. G. G. Chisholm, M.A., considered that a committee, including some school teachers, should be nominated by the R.G.S. to draw up a syllabus in geography, brief but elastic enough to be applied to all sorts and conditions of schools. The chairman considered this a valuable suggestion, which he would discuss with his colleagues on the School Management Committee. Votes of thanks were given to the speakers.

THE MONTHLY RECORD.

EUROPE.

Revision of the Ordnance Survey Plan of London.—We have received a communication from Colonel Washington, Director of the Survey Department of the Land Registry Office, pointing out, as likely to be of interest to members of our Society, that during the past three years his department has revised the whole of the $\frac{1}{1056}$ Ordnance Survey plans of the County of London (except the city), very considerable additions having been made in respect of the area newly built over in Hampstead, Fulham, Putney, Tooting, Wandsworth, Streatham, Lewisham, and Plumstead. The large-scale survey has also been extended at Lewisham and near Abbey Wood, and a further extension is in progress near Eltham. This revised work has not been published, but Colonel Washington states that the manuscript plans are available for reference on application.

German Hydrographical Research in the Baltic.—Some account is given in the *Geographische Zeitschrift* (1901, part 10) of a German expedition for marine investigation in the Baltic, which commenced work in August last, under the direction of Fishery-Inspector Heidrich, in the s.s. *Holsatia*, and was well fitted out with instruments for hydrographical and biological work. It was accompanied by six cutters, which were to endeavour to inaugurate a fishery in the open waters of the Baltic. The expedition is regarded as preliminary to the regular work to be started this year in accordance with the resolutions of the Christiania Conference.

The Reclamation of the Zuidersee.—The long-discussed project for the reclamation of the Zuidersee by the construction of a dam across its mouth has during the past year come a step nearer realization through the introduction of a bill into the second chamber of the Dutch States-General, a full account of which, with a *résumé* of the whole history of the project, has lately been given in a foreign office report by Sir H. Howard. The attention devoted to the subject within recent years has been principally due to the labours of the Zuidersee Association, originally formed at the instance of Mr. A. Buma, which resulted in the inception of a practical scheme described in 1893 in the first volume of the *Geographical Journal* (p. 234). The scheme was fully examined by a State Commission, which in 1894

reported to Government that the proposals of the association should, in their opinion, be undertaken with some modifications, and that the work ought to be carried out by the State. The scheme of the Zuidersee Association, as revised and amended by the State Commission, forms the basis of the bill introduced last year by Mr. Lely, minister of "Waterstaat." Its main features agree with those described in the *Journal* in the article alluded to, the most important work being the erection of a great dyke running from the north Holland coast through the Amstoldiep to the island of Wieringen, and from that island to the Friesland coast at Piaam, the result of which will be the formation within the dyke of a fresh-water lake, principally supplied by the waters of the Yssel. Some alteration has, however, been introduced with regard to the subsequent works for the reclamation of portions of the enclosed area. The first area to be dealt with will still be that in the north-west between Wieringen and Medemblik, but the next will not be in the south-east, but in the south-west, between Hoorn and Marken. It is claimed for the scheme, which differs from some of the older ones in including the mouth of the Yssel within the enclosed area, that it will benefit the country, not merely by bringing a large area of new land into cultivation, but also as providing an additional supply of fresh water for the province of Friesland, the surface of which at present receives no other water than that which falls as rain; as promoting the more efficient discharge of surplus water into the sea; and as improving communication both by land and water. The generally lower water-level, as compared with the present, within the Zuidersee will facilitate the discharge of the inland waters, and even when high tides in the open sea prevent the discharge to the latter through the sluices for a few days, the water will not rise to such a height as to cause damage, as is often the case at present. A further advantage is the important reduction of the length of coast to be defended from the sea. The total cost of the work is reckoned at nearly £8,000,000, which it is proposed to raise by loans, to be paid off within sixty years. Of this the great dyke alone will absorb nearly 2½ millions, and will require over eight years for its completion, the entire scheme involving operations extending over eighteen years. This allows for the reclamation of only the two areas mentioned above, but the creation of other "polders" would no doubt follow in time.

ASIA.

Geological History of the Son Valley.—An interesting monograph on the geology of the Son valley, by Mr. R. D. Oldham and two other members of the Geological Survey of India, has been issued as the first part of vol. 31 (1901) of the Memoirs of the Survey. Mr. Oldham contributes the sections dealing with stratigraphy and physical geography, with the latter of which—in great measure, however, dependent on the former—we are more especially concerned here. The most striking physical features of the area under consideration are, firstly, the great Vindhyan scarp, forming its northern boundary, and known further west as the Kaimur range; and, secondly, the great strike-valley of the Son, corresponding almost entirely with the outcrop of the softer rocks of lower Vindhyan age. South of the latter comes a series of more or less parallel but discontinuous ridges, traversed by rivers running northwards across the strike of the rocks of the transition systems which occupy this area. The surface features are directly dependent on the structure of the different areas and on the differential action of denudation on the hard and soft beds of which they are composed; and Mr. Oldham shows that the nature of the ridges varies, as it might be supposed to do from theoretical considerations, with the angle of dip of the component rocks. From various evidences adduced of diversion and concentration of drainage, the conclusion is

drawn that the land has for a long period been exposed to subaërial denudation, and that the present river-channels may be very different from those which existed previous to the last considerable change in the levels. For the elucidation of the past history of the region, the Vindhya scarp, unique in the entire absence of deep-cut cross-valleys, is of great importance. It completely interrupts the general northward trend of the drainage in the Son valley, which is intercepted by the main stream at its very foot. The most important problem to be solved is whether the great east-to-west portion of the Son valley was formed prior to or consequent on the last great uplift; or, in other words, whether there is any trace of drainage channels having crossed the Kaimur range from south to north, at a time when the whole surface was one of low relief, whence hills rose by gentle slopes from broad open valleys. Mr. Oldham shows that on the one hand the absence of important tributaries from the north points to a recent origin of the present valley of the Son, all the streams from that direction giving evidence of recent erosive action; while on the other, the absence of wind-gaps in the Kaimur scarp points to its antiquity. The choice between the two suppositions is facilitated by a consideration of a peculiar feature in the course of the Son, viz. the southerly deviation of the stream near Marai, and its double passage through one of the most prominent ridges of the district. This can only be explained by supposing that the course of the river was already fixed at a time when the form of surface was determined by different conditions to those now prevailing, and has been superimposed on the present surface features. The formation of the valley cannot therefore be ascribed to diversion of drainage during the last great uplift. It must, however, be due to the greater softness of the lower Vindhyan shales, and to diversion and concentration of drainage along this soft band, but these processes must have been at work during long ages prior to the last period of upheaval and active erosion.

Dr. Sven Hedin.—Telegraphic intelligence received on December 19 announced the arrival of Dr. Hedin at Ladak, whence it appears that the traveller has successfully carried out his intention of crossing Tibet to the source region of the Indus (*Journal*, vol. xviii. p. 289).

Return of Lieut. Kozloff.—The St. Petersburg *Novosti* announces the safe return to Kiakhta, on November 30 last, of Lieut. Kozloff's Expedition, thus finally disproving the rumours of disaster circulated last summer.

AFRICA.

The African Society and its Journal.—More than a century has passed since the foundation, under the title of the African Association, of a society whose special aim was the acquisition and diffusion of an improved knowledge of the then mysterious African continent. The first year of the twentieth century has seen the inauguration of another body, whose aims, subject to the altered conditions introduced by a century of exploration and political change, are still practically the same. Founded primarily as a memorial of the late Miss Mary Kingsley, and for the purpose of continuing her work, the African Society has now extended its sphere of operations, and holds as its objects the general furtherance of knowledge of Africa and its peoples, and the legitimate development of its commerce and industries. As a foremost means of attaining these ends, the society has decided to publish a periodical, to be known as the *Journal of the African Society*, of which the first number was issued for October, 1901. It consists of a memoir of Miss Kingsley, by Mrs. J. R. Green; a series of articles on African subjects by various contributors; and a supplement containing a report of the inaugural meeting of the society, and a reprint of the rules, list of members, and so forth. With the objects of the society as above set forth there

can be nothing but sympathy, and if a doubt may make itself felt at all with respect to the new undertaking, it can only arise from a wish to be assured that existing channels are insufficient for the attainment of those objects, and an unwillingness, if such were not the case, to see the already unwieldy mass of periodical literature swelled by an unnecessary addition, however excellent in itself. That a new weapon is needed for the attack of prevailing ignorance on African affairs, is the opinion of the founders of the society, who expressly disclaim the wish to trespass on ground already occupied; and there is no doubt that much good work may be done in the direction of popularizing the study of Africa and its peoples, and bringing before the general public a mass of existing information hitherto known only to experts. Such papers as that by Dr. Wright on German methods of development in Africa, and Colonel Stopford's on West African law and custom, are certainly useful from this point of view. The personal element introduced by the association of the society's work with the memory of Miss Kingsley is, as was pointed out by various speakers at the inaugural meeting, an advantage, as tending to enlist the sympathies of a wide circle. At the same time it carries with it risks which need to be guarded against. A certain tendency is to be observed, on the part of some members of the society and contributors to its *Journal*, firstly, to accept as beyond dispute the opinions advanced by Miss Kingsley; secondly, to ignore the large amount of good work done by former investigators;* and, thirdly, to exaggerate the merits of foreign as compared with British methods, again, no doubt, owing to a too unquestioning faith in Miss Kingsley's views. Such a tendency—for it goes no further—is, after all, a natural outcome of a desire to do honour to one whose powers of mind and nobility of character were alike exceptional.

New Ascent in the Ruwenzori Range.—Since the visit of Sir H. Johnston to the Ruwenzori range as described at the opening meeting of the present session, a further attempt to ascend above the snow-level has been made by Mr. W. H. Wylde, whose journal, kept during the trip, has been kindly sent for our perusal. Leaving Kampala on July 12 last, Mr. Wylde went first to Fort Portal, where he was joined by Mr. Ward, who accompanied him in the attempt on the mountains. Starting thence on August 5—an earthquake shock having been experienced during the previous night—the travellers, like their predecessors, made their way up the Mubuko valley, the real climb beginning on the 8th. After despatching their last solid meal on the morning of this day, they took a few light articles—blankets, great-coats, a small tent, and a small supply of food—and began the ascent with two or three native followers. Mr. Wylde gives a graphic account of the deep gorges, traversed by the foaming river and clad in thick ferny forest, which were passed on that day. Having reached the ridge between the Mubuko and Murumbo valleys, the party made their camp under a huge beetling rock, falling 800 to 900 feet to the Mubuko. In the evening weird sounds were heard, attributed by the natives to a "devil," but possibly due to an owl. The 9th commenced with thunder and rain, the wind blowing chilly. Pushing on through the region of bamboos and heather, up valleys grey with moss and filled with swirling cloud, a level plateau was reached, and, both travellers now feeling ill, camp was formed under a precipice after a seven hours' climb. The scenery still made a weird impression, being, Mr. Wylde says, totally unlike any to which one is accustomed elsewhere. On the 10th, after a sleepless night, a start was made for the snow, much headache

* Archdeacon Sinclair, in an article on the African Association of 1788, ignores the fact that the Royal Geographical Society was the direct successor of the Association, and that it can hardly be said to have neglected the work of African research.

and nausea being experienced. Passing with difficulty through a narrow funnel, the glacier was reached, and a view obtained of the towering summit of Msagamgura (the peak on which the attempt was being made), and of the still huger Kichuchu, snow-capped, with glaciers on the flanks. Behind rose the peak of Kyangi, said by the natives to be higher than the others, and, further still, Ngoma, looking utterly inaccessible. Sending back the natives, the two Europeans climbed, with the aid of entrenching tools, up the glacier and over masses of disintegrated rock, with a precipice below them. After an hour's climb they decided to turn, the peak being still apparently far above them. After another bad night, food having also run short, a start down the mountain was made at 8 a.m., and the former camp reached after nine and a half hours' incessant labour, both travellers suffering severely from their exertions. Mr. Wylde says that he and his companion ascended 500 feet (by aneroid) beyond the spot pointed out to them as that at which Sir H. Johnston turned, the total altitude being 15,000 feet. He estimates the highest peak at 19,000 feet at least, and says that, though a fully equipped traveller might succeed in reaching the summit, this is doubtful, owing to the trying climatic variations and the intense physical discomforts experienced.

Baron Erlanger's Expedition in North-East Africa.—We some time ago recorded the return of Herr Oskar Neumann from his expedition through the Galla countries, begun in company with Baron Erlanger. The latter has since also returned to Germany, having, after separating from his companion, made his way south-east to the mouth of the Jub (*Globus*, vol. 80, p. 325). Baron Erlanger's route was described in the last volume of the *Journal* (p. 214), as far as Ginea, or Ginir, where it struck that of Dr. Donaldson Smith in 1894. Here he got together a new caravan, and pushed south to the Ganale, which was struck below the mouth of the Mane. It was followed down to Dolo, at its junction with the Daua, which latter was ascended a short distance, the caravan then turning south-west to Wak. Baron Erlanger hoped to strike across the unknown southern portion of the Boran country to the south end of Lake Rudolf, but was prevented by the absence of water. Instead, he turned south-east through the Somali country, in which the revolt was then proceeding, and, striking the Jub, followed this to its mouth.

M. Le Roux's Explorations in Southern Abyssinia.—The October number of *La Géographie* contains a fuller account, accompanied by an excellent map, of the journey made early in 1901 in Southern Abyssinia by M. Hugues Le Roux, to which reference was lately made in the *Journal*. M. Le Roux's surveys in the country south of the Blue Nile supplement the work done by Mr. Oscar Crosby to the north of that river (*Journal*, July, 1901), but, as far as its course is concerned, merely confirm the statements and map of the latter traveller, the extreme southern point reached by the river being only just south of 10°. The French traveller's surveys also complete those of Mr. Weld-Blundell's expedition of 1898–99, the routes of the two expeditions practically coinciding for the first half of the way from Addis Abbaba, though further west they separate, M. Le Roux having turned north to the Abai after crossing the Didessa, instead of continuing west to the Dabus. His map is based, as far as the topography is concerned, on plane-table work, for which the nature of the country, with many isolated peaks scattered over the surface, lends itself well. Among other summits, the Tulu (peak) Choki (9760 feet) was climbed, and a round of angles taken, which enabled the features to be sketched in as far east as Gara Limmu, a wall-like escarpment stretching south of the Abai some 80 miles from the point of observation. In the angle between this wall and the course of the Abai the country is said to consist of an undulating plateau, wooded and swampy,

and furrowed by torrents which lose themselves without forming a definite hydrographical system. It contains villages of the Shankalla,* or Beni Shongul, and is bordered on the south by a cold mountainous tract. M. Le Roux visited the junction of the Didessa with the Abai at the most southerly point reached by the latter,† and also that of the Angar with the Didessa, and his map shows that the last-named resembles the Abai in the devious character of its course, flowing in a sharp easterly bend before finally resuming its north-westerly course before its junction with the Abai. At the entrance of the Angar into the Didessa the former is an impetuous mountain torrent, swollen by the waters which descend the Gara Limmu escarpment, and though less copious than the Didessa, turns the latter aside from its course for a short distance owing to the violence of its rush. At the angle between the two streams a hot spring was discovered.

Explorations in Tripoli.—In April and May, 1901, a French traveller, M. de Mathuisieulx, was fortunate enough to have the opportunity of visiting portions of Tripoli which have been traversed by no European since Barth's visit of 1845. An outline of the results was given in the number of *La Géographie* for August last. M. de Mathuisieulx arranged his routes so as to cover the greater part of Tripoli proper, visiting in turn the oasis of Beni Suadi, the Gariana mountains, and the Jebel Iffren, and returning to the coast at Zuara near the Tunisian frontier, whence the route was continued by the shore to Tripoli. A new journey led east along the coast to Lebda, and thence inland to the Msellata hills and the plateau of Tarunha. The traveller describes in turn the zones formed by the coast-line, the plains, and the mountains. With regard to the last, he says that it is a mistake to suppose that their spurs run out to the vicinity of the sea. Such is not the case. Some 6 miles from the base of the chain, the plain begins to ascend gradually until it reaches an altitude of 1000 feet, this sloping ground being covered with poor fields of barley and tamarind trees, while flocks of large-tailed sheep are also seen. The escarpment of the higher ground is steep and furrowed by ravines. Above, the country ill accords with the name of "Little Switzerland" sometimes given to it. It is rather an Arabia Petræa, for the plateau which extends southward some 40 miles at a nearly uniform elevation of 2300 feet is little more than a stony desert, with occasional patches of wild olives, and at one or two spots gardens of figs and pomegranates. Between Gariana and Iffren there is a vast hollow in which remains of Roman tombs were found, while the whole region abounds in subterranean dwellings. The only cultivable tracts in Tripoli proper are—(1) a portion of the coast west of the capital; (2) the Lebda hills; (3) a few valleys in the Gariana and Iffren mountains. The situation shows no prospect of improvement, but rather of growing worse, as the dryness is constantly increasing.

Dr. Weisgerber's Surveys in Morocco.—Dr. Weisgerber, whose explorations in Morocco have already been referred to in the *Journal*, has lately surveyed a route from Casablanca to the Um-er-Rbia, a sketch-map of which, with a description of the country traversed, is given in *La Géographie* for October last. Although the route is fairly well known, the new survey adds somewhat to the topographical details on the map, and rectifies Dr. Weisgerber's former map as regards the position of Settat, which was placed some 5′ too far west. The traveller describes the following zones successively traversed by him: (1) the Sahel,

* This name was applied to these people by the early Jesuit missionaries, and inserted by Ludolf in his map.

† Although the junction of the two streams was not visited by Mr. Blundell, the correct latitude is assigned to it in that traveller's map.

consisting of a series of parallel ridges separated by depressions; (2) the region of the "Tira," a vast plain covered with rich black soil, rising gradually towards the south; (3) the Mzamza hills, from the midst of which the traveller descends to the valley of Settat; (4) the southern plateau of the Shawia, a rugged upland varying in height from 1450 to 1570 feet: though comparatively fertile in the north, it becomes more and more desolate towards the south; (5) the desert of the Beni-Meskin, stretching south from the Jebel Ftatin to the Um-er-Rbia. The lower course of this stream has, it will be remembered, lately been explored by Dr. Fischer (*Journal*, vol. xviii. p. 91).

Exploration in the Northern Ubangi Basin.—Explorations of two of the northern tributaries of the Ubangi have lately been made by French officials representing the commercial companies to which concessions have been granted by Government in that region. The Kotto, whose basin, as first shown by the Belgian travellers Nilis and Khétulle, extends almost up to the borders of Darfur, has, we learn from the *Bulletin* of the Comité de l'Afrique Française (September, 1901), been examined in its hitherto unknown middle course by M. Superville, who made his way by land to the factory of Hirra, about 200 miles above the mouth of the river, and pushed on to Barang Bakie (probably the ancient Foro),* a little below the confluence of the Ji. Unable to advance further, he sent one of his agents, M. Poisson, to establish a factory on the Bungu, a navigable stream coming from the north-west and 150 yards wide at its junction with the Kotto. The Bungu also was reached by Lieut. Bos, a Government official who had accompanied M. Superville to Barang Bakie. M. Superville himself descended the Kotto in canoes, finding it generally navigable even at low water. Its basin produces large quantities of ivory and rubber, but, apart from the gallery forests along the streams, the country is as arid as the Egyptian Sudan, being covered with grass and thorny scrub. Lieut. Bos is said to have pushed north to the upper Kotto and Dar Banda, executing a survey of hitherto unvisited districts. Further west, the course of the Kuango, which joins the Ubangi almost at its most northerly point, has, according to the *Mouvement Géographique* for October 20 last, been explored by M. Georges Séguin, who reached a point 110 miles beyond Vangèle's furthest, being then, however, stopped by a fall (that of Baidu) in about 5° 50′ N. From this point to the Lumba rapid, at which the *En Avant* was stopped in 1891, the general course of the river is from north to south. Its banks are generally high, and it varies in width from 150 to 200 yards, but is much obstructed by islands, rocks, and sandbanks, which make navigation difficult. The level of the stream varies rapidly according to the weather. A dense population was met with, especially on the right bank, and rubber was everywhere seen, but elephants are absent.

The Congo State Telegraphs: Mr. Mohun's Expedition.—The American consul, Mr. Mohun, who went out by the east coast in 1898 to establish a telegraph line between Tanganyika and the Congo, has, we learn from the *Mouvement Géographique* (1901, No. 45), lately returned to Belgium by way of the Congo, having fulfilled his commission. The Manyema telegraph line extends from New Kasongo on the Congo above Nyangwe to the post of Sungula, a little distance from Tanganyika, and has a total length of 286 miles. New Kasongo has acquired

* The reasons for this identification are not given. Lupton Bey crossed the Engi (which seems to be the Ji of M. Superville) on his way west to Foro, which would therefore be *above* the junction of the Ji with the Kotto. The proper name of the latter is said to be Kuta, and the river may quite possibly be the Kuta of Nachtigal, though hardly that of Lupton.

much importance as a trade centre, and from this point all down the Congo, Mr. Mohun was struck with the flourishing condition of the Belgian ports, and with the safe condition of the country.

M. G. Grandidier in Southern Madagascar.—M. G. Grandidier, son of the veteran explorer of Madagascar, undertook, early in 1901, a new journey in the little-known southern portion of the island, where he had already carried out important explorations two years before. His progress down to August last is recorded in the October number of *La Géographie*. The first journey led from Fort Dauphin, at the south-east corner of the island, to Tulear on the west coast. As far as Tsiombe, on the Manambovo, the country was less dry than had been supposed, and was also unexpectedly well peopled, the population being in places as dense as in Imerina, while much cattle is reared. All the vegetation is either thorny or succulent. Beyond Tsiombe M. Grandidier was guided by the son of the principal Antandroi chief across a plateau on which not a drop of water is found for four days. Reaching the sea at False cape, he followed the coast to Cape Sainte Marie, where a true *terra incognita* commenced. He kept near the coast as far as the mouth of the Menarandra and the little port of Ampalaza, discovered by Houtman during the first Dutch voyage to the east, and then turned north, crossing the upper Ilinta and reaching Tulear at the beginning of August. This whole region forms a vast level plateau covered with thick thorny bush, but fairly peopled. The food of the inhabitants, who light fires by rubbing two sticks together, consists for some months of the year solely of the leaves and fruits of the Barbary fig. The journey was a severe one, and the party suffered from want of water, but the route was thoroughly surveyed. From Tulear, M. Grandidier visited Lake Tsimanampetsotsa, discovered by his father in 1868, mapping the whole neighbourhood. On August 25 he set out for the Mangoka, but intended afterwards to return to Fort Dauphin by a new route.

The Geodetic Survey of South Africa.—The report for 1900 of the astronomer at the Cape of Good Hope includes a summary of the progress made during the year with the geodetic survey of South Africa. Mr. A. Simms, with his assistants Messrs. Heatlie and Antrobus, reached Salisbury on March 31, having spent the rainy season chiefly in experiments at the Cape with Jäderin wires for base-measurement. The angles at fourteen new stations, extending as far as Nyamanje (16° 30′ S., 30° 45′ E.), were measured before the annual grass fires put a stop to observation. The measurements at eleven points already beaconed, and at four or five still to be selected, were left over for completion in 1901. A base-line near Gwibe was measured in November and December, 1901, and the Jäderin wires sent to the Cape for recomparison with the standard bars, the result being to show that all the wires had apparently contracted about one part in 100,000 between August 17 and September 3, 1900, and January 16–23, 1901. Progress was made during the year with the operations of the Anglo-German Boundary Survey, in spite of difficulties of water-supply and transport, a base-line having been measured near Gobabi's in 22° S. Work has been in progress for the re-reduction of the survey made by Captain Bailey in 1859–62 along the south coast of Cape Colony, the original printed report having been full of typographical errors. Operations for the proposed measurement of a great arc of the meridian along the 30th degree will probably be commenced in the south between Natal and the Limpopo, as soon as the country is in a sufficiently settled state. The project has the full support of Sir Alfred Milner, and a resolution of sympathy with the objects of its promoter was passed at the Paris meeting of the International Geodetic Association in September, 1900.

AMERICA.

Surveys in the Hudson Bay Region.—A second report of progress in the exploration of the country between Northern Quebec and James bay was printed last year by order of the Canadian legislature. The work, which extends and completes that carried out by Dr. Robert Bell, as described in the *Journal* for July, 1897, has been executed (1897–99) by Mr. Henry O'Sullivan, Inspector of Surveys for the Province of Quebec, on behalf of the Department of Colonization and Mines in that province. The general nature of the country was so well described by Dr. Bell that Mr. O'Sullivan's report, which gives a detailed description of his various routes in the area lying between Lake St. John, Lake Mistassini, and the south end of James bay, adds little to our knowledge on this score, though making considerable addition to the minute topography of the region. The results of Dr. Bell's surveys are confirmed in a marked degree, few alterations of any importance being introduced into his delineations of the complicated systems of rivers and lakes, with their extremely winding contours. The most important of the new routes lay in the tract to the south of Lake Mistassini, stretching westward to Waswanipi lake, where a good deal of new detail was filled in. Altitudes were taken along all the routes, and a section of the country from Lake St. John to James bay is added to the large map. This contains a large amount of minute work, but the fineness of the drawing makes it difficult to obtain from it a general idea of the hydrographical system. Mr. O'Sullivan adds some remarks on the prospects of the country, and the best means for its development. At present want of communication with the rest of the world causes the resources of the whole region to lie dormant and to be of little value to any one, and Mr. O'Sullivan sees little prospect of a successful opening of a sea-route through Hudson strait. But with the construction of a railway from the south, he thinks they will in time be utilized. The enormous forest wealth is at present that most capable of exploitation, and this by the utilization of the great rivers. The mouth of the Little Nottawai (the Broadback river of Dr. Bell) is said to be the most advantageously situated for extensive pulp industries, a special advantage being the fact that water-power can probably be had on it close to tide-water. It has many large lakes as reservoirs, and its ordinary low-water flow is reckoned at 25,000 cubic feet per second. Mr. O'Sullivan considers that the whale and other fisheries of Hudson bay, and the various indications of minerals throughout the entire region, must sooner or later call for direct railway communication; and he looks forward to the time when Quebec will have its counterpart on James bay, both lying on the track of the shortest trans-continental line of railway. In the last section of the report he discusses the various routes which have been proposed for a railway in the light of his knowledge of the surface features of the country. As a colonization road, he favours a line running from Lake St. John to James bay, but as part of a future trans-continental system, as well as for the development of the lumber industries, a more direct line from Quebec to the bay, leaving the existing Lake St. John line about 77 miles from Quebec, and following the upper valley of the St. Maurice, would be preferable.

The River-system of Connecticut.—A careful and instructive study of the river-system of Connecticut as determined in its main features by the geological structure planes of the country has lately been made by Mr. W. H. Hobbs, of the U.S. Geological Survey, in the twenty-first Annual Report of which department the full results are printed (Part iii., 1901, pp. 1–162). A summary of the most important facts brought out by the study is given by Mr. Hobbs in the *Journal of Geology* (vol. ix. No. 6, 1901). Although the apparent relationship between the

fault-directions of a country and those of the stream-channels has been pointed out by various observers, the writer believes that the only detailed studies which have been made establishing the definite relationship between the two systems are his own in the Pomperaug valley region of Connecticut, and that of Brögger in Southern Norway. The results of both are equally remarkable. In the region studied by Brögger, almost every valley and cleft was found to be formed along a fault-fissure; while the correspondence proved to exist in Connecticut by Mr. Hobbs between drainage lines and structure planes is, as he says, far too close to be accidental. In the Pomperaug valley area the crust is divided, by various intersecting series of parallel, nearly vertical, joints and faults, into a large number of orographic blocks, the smallest of which measure, quite generally, about 50 paces by 100, regularity of spacing of the fault-lines being as marked as their parallelism. The most common directions of the joints and corresponding faults are approximately N. 34° W., N. 55° E., N. 5° W., and N. 15° E. The first two of these are nearly normal to each other, but the larger throws within the region seem generally to have taken place in the directions N. 55° E. and N. 5° W., which give the directions of the sides of the smallest or "unit" blocks, which are equivalent to two rhombic prisms in contact along one side. The various fault-directions are shown to correspond with those of the diagonals of single "unit" blocks, and of associations of these forming composite blocks (*e.g.* three units long and two wide, four long and seven wide, etc.). The whole system of fault-planes may be explained as due to compressive stresses, the resultant of which acted in a direction normal to the axis of Green mountain folding (N. ± 80° W.). The fault-directions can only be traced with precision in the Newark beds of the Pomperaug basin, but it may be concluded that they extend beyond this to the wider area, of which the whole Connecticut valley is but a part, which seems to have been subject to the same general stress. In the Pomperaug valley it was found that the streams, large and small, for considerable distances, adhere with great fidelity to the directions of some of the principal faults, and on extending the study, first to the Shepaug basin and subsequently to still wider areas, up to that roughly coextensive with the state of Connecticut, that the same directions were maintained more or less closely by the watercourses. Maps are given in which the river system has been traced from the U.S. Geological Survey Atlas Sheets, and the principal fault directions above mentioned have been added; the correspondence between the two systems, especially in the case of the direction N. 44° W., being very striking.

Origin of the Name "Cape Nome."—Prof. George Davidson some time ago set himself the task of elucidating the origin of the appellation Cape Nome, which has long been a puzzle to those to whom the question has suggested itself. For a long time he was unsuccessful, but has at last obtained a solution of the problem, which supplies an interesting example of the extraordinary corruptions to which legends in maps may be subject. It is given in the *National Geographic Magazine* for November, 1901. Prof. Davidson traced the name back to the British Admiralty chart of 1853, but no further, it not having appeared in Tebenkof's great Atlas published in 1848–52. It seemed highly probable that the name was given during the cruises of the Franklin rescue ships *Herald* and *Plover* (1845–51), but no published account of their voyages contained anything to throw light on the question. Applying to the present hydrographer of the Admiralty with a view to finding whether the name appeared among the lists of officers of the *Herald* and *Plover*, Prof. Davidson at last obtained the wished-for solution, though not in the way expected. It is supplied by an officer who was on board the *Herald* when the manuscript chart of the Cape Nome region was constructed. On this chart attention was called to the fact that the Cape had no name by the insertion of the

remark "? name" against it. The note of interrogation appears to have been inked in by a draughtsman on the *Herald*, and appeared as "C. Name," but, the *a* being indistinct, was interpreted by the Admiralty draughtsman as Cape Nome, appearing so in the chart of 1853 and in all subsequent maps.

The Costa Rica—Columbia Frontier.—It appears that the award given in September, 1900, by the President of the French Republic in the frontier question between Costa Rica and Columbia has not finally removed the possibility of misunderstanding in the matter. The obvious interpretation of the award gave to Columbia the whole of the Tarire basin, thus thrusting a wedge of Columbian territory far within the normal course of the line as shown on previous maps. This was the view taken in an article by Dr. Seler in *Petermanns Mitteilungen* for December, 1900, and in the accompanying map, both of which were reproduced without question early in 1901 by the Instituto Fisico-Geografico de Costa Rica in its bulletin. Recurring to the question, however, this paper has since questioned the correctness of Prof. Seler's views, showing that the award of the whole Tarire basin to Columbia would be inconsistent with the compromise which formed the basis for the consideration of the case by the arbitrator. In a new map given in the bulletin of the Institute, the line is shown as running southwards across the Tarire basin in order to reach the continental water-parting which afterwards forms the boundary, though it is not clearly shown how this can be squared with the terms of the award. It seems hardly likely that these were incorrectly reported at the time in all the newspapers and periodicals which referred to the matter. Yet in the November number of the *Geographische Zeitschrift*, a note appears in which the line is said to start from the coast at Monkey or Carreta Point, and follow the ridge bounding the Tarire basin on the *south*, not north as originally reported. It may be observed that the Costa Rican map, which is said to embody the results of the latest surveys, shows a second river named Tararia south of the Tarire basin, and it seems possible that a confusion between the two rivers may account for the varying interpretations of the award.

Tides and Sandbanks in the La Plata Estuary.—An attempt to correlate the contours of the ground in the La Plata estuary with the influence of the tidal *régime* has lately been made by the Argentine engineer, J. Figueroa, who has worked out, on behalf of the Ministry of Public Works, the results of surveys on the coasts of the republic. His observations on the La Plata estuary appear in a work entitled 'Estudios sobre puertos de la provincia de Buenos Aires,' an extract from which is given in part vii. of the *Annalen der Hydrographie* for 1901. The outer part of the estuary is obstructed off Montevideo by a group of sandbanks (Archimedes, English, and Rouen banks), between which and the coast on either side are deeper channels, both of which trend towards Montevideo, the more southerly following the curvature of Samborombon bay. The same general features are repeated above Montevideo, the centre of the estuary being again obstructed by the Great and Little Ortiz banks, with deeper water on either side. The western channel is, however, shut off by a continuous bar from the outer deeps. The tidal phenomena to which the formation of the banks is attributed are thus described. The state of the water at different parts of the estuary varies immensely at the same moment, high water occurring so high up as Buenos Aires much earlier than at Cape San Antonio, the southern portal of the estuary, while the ebb actually begins at Montevideo simultaneously with the flood at Cape San Antonio. It is plain from this that the tidal wave which passes Montevideo and makes its influence felt in the inner part of the estuary, is not the same as that which shows itself between Cape San Antonio and the northern end of Samborombon bay. The first or northern wave comes from the east and south-east;

opposite Piedras-Huk it divides into two, one branch ascending the river as a flood-wave, the other making its way as an ebb to Samborombon bay. The second or southern wave runs as a flood-wave north-east past Cape San Antonio, but then joins the outflowing stream, and is carried with it towards the east. In this way Señor Figueror explains (1) the differences in the time of high water; (2) the banks formed east of Piedras Huk, the point at which the two main streams separate; (3) the circular form of Samborombon bay; (4) the outer banks which lie in the centre of the circle described by the currents, and are thus the depositing-ground of the earthy and sandy materials brought by the river and the tide. Against this theory, Herr Herrmann, the writer of the notice in the *Annalen*, quotes the experience of Captain Danielssen, who, during many voyages from the south to Montevideo, has never noticed any great easterly displacement of the water in the estuary, though other captains tell a different tale. He thinks, also, that the tidal phenomena are too irregular, owing to their dependence on changing winds, to justify Señor Figueroa's description of them as permanently applicable.

Examination of the Rio Santa Cruz, Patagonia.—A detailed survey of the Rio Santa Cruz, and of the Lago Argentino, from which it makes its exit, was carried out at the close of 1899 and beginning of 1900, under the orders of the Minister of Marine in the Argentine Republic, by Captain A. R. Iglesias, whose report on the results of his labours has been published officially at Buenos Aires. It forms a valuable addition to our knowledge of Southern Patagonia. The river was ascended in a steam-launch drawing about 3½ feet, accompanied by a six-oared gig towed astern, the mean speed maintained when at full steam being 6 knots. Besides executing a careful topographical survey of the course of the stream, Captain Iglesias carried out scientific observations on the tides, depth, and velocity of the stream, meteorology and magnetism, also collecting information as to the nature of the country on its banks, and the present position as regards its settlement. He was accompanied by Dr. Felipe Silvestri, a naturalist sent by the Ministry of Agriculture, who made collections of birds, fishes, insects, plants, etc., and generally studied the geology, fauna, and flora of the country. The report contains a minute topographical description of the course of the river, illustrated by views, as well as careful instructions for its navigation, for which the employment of a steamer drawing 3½ feet and capable of steaming 10 knots is recommended; the examination having shown that the river may prove of much use as a means of communication. With regard to the prospects of development of the country bordering the river and lake, Captain Iglesias sums up as follows: The lands to the north and south of the river are in general but little fertile, though suitable for sheep-farming, those to the south being capable of supporting the larger number per square league. It is estimated that the area which the establishment of regular navigation would throw open to settlement would support in all some 2,000,000 head of sheep. A considerable extent of land in the vicinity of Lago Argentino presents more favourable conditions, stock of all kinds thriving to a surprising degree, while the land is suitable for agriculture on a large scale, and the forests to the west are capable of exploitation, both for exportation and for home consumption. The foundation of a colony on Lago Argentino is therefore very desirable, and in its interest the construction of a telegraph line from the Puerto de Santa Cruz to the lake is recommended.

AUSTRALASIA AND PACIFIC ISLANDS.

Iron Ores in New South Wales. A valuable report on the Iron Ore deposits of New South Wales, by Mr. J. B. Jaquet, has lately appeared in the *Memoirs of the Geological Survey of New South Wales* (Geology, No. 2, 1901).

Although, when European navigators first reached the shores of Australia, they found the inhabitants without iron, this was not owing to absence of workable ores, and it is now half a century since the first attempt was made to establish the iron-smelting industry in New South Wales, furnaces having been set going about the middle of last century, near Mittagong, on the southern railway, and at Lithgow, on the western. The quality of the ore and of the iron produced was excellent, and pig-iron was even exported in 1867 to the United States. But the expense of carriage of coal and limestone, and the high price of labour, raised the cost of the product to a prohibitive extent. The question of renewed experiments has been continually before the public of late years, though hitherto without result. Mr. Jaquet has, however, now made a careful survey of all the deposits of iron ore known to exist within a reasonable distance of those centres which, by reason of their proximity to supplies of coal and limestone, may be regarded as suitable for the establishment of smelting works. The result has been unexpectedly favourable, the available supplies of ore being shown to be vastly greater than had been anticipated. The most important deposits are those at Carcoar and Cadia, lying north-west and south-west of Blayney, on the western railway. They are distant from each other only 15 miles, the ore occurring in a belt of Ordovician rocks—clay-slates, argillaceous sandstones, etc., with interstratified lava-flows—which extends between the two places. The importance of these beds lies in their extent, quality, and relative proximity to coal and limestone. Detailed descriptions of these deposits, and of various others which he has examined, are given by Mr. Jaquet in his report, and are illustrated by maps and sections. In a concluding chapter the writer sums up the estimated minimum quantity of ore available at the several localities, and compares it with the quantity of pig-iron represented in the present iron imports of New South Wales and Australasia as a whole, according to the estimate of Mr. Coghlan, the Government statistician. The result is, he considers, to show that there is sufficient iron ore in sight in New South Wales to produce all the iron required by the various colonies of Australasia for many years.

Explorations on the Main Watershed of British New Guinea.—An interesting account of a Government Expedition, lately carried out across the main range of the eastern part of British New Guinea, was given before the Queensland Branch of the Royal Geographical Society of Australia in April last by Sir Francis Winter, chief judicial officer in the possession. The expedition is said to have been in charge of Dr. J. A. Blayney, Captain J. R. Barton, and Mr. A. E. English, but Sir F. Winter seems to have accompanied the party, which set out from Cheshunt bay on September 2, apparently in 1900, but the year is nowhere stated. Its object was to endeavour to secure the arrest of some men of the Puneaburu and Dorevaida tribes, who were implicated in an attack on the village of Merani, near Sandbank bay; and then to travel eastwards to the Keveri valley, which had been reached earlier in the year from Cloudy bay by Dr. Blayney and Mr. English. The main village of Puneaburu, which lies at a height of about 2300 feet on the first high range, was reached from the south on September 9, but was found to be deserted. It was defended by a stockade and three tree-houses. These latter are constructed, Sir F. Winter says, solely for purposes of defence, and the height at which they are placed above the ground is often over-estimated, probably never exceeding some 60 feet. No attempt seems ever to be made to cut down the trees, such a proceeding being stated by the people on one occasion to be quite contrary to native customs. A Dorevaida village was next visited and found to be unenclosed by a stockade, the people apparently trusting to the awe inspired by their prowess. They had, however, deserted their village, though three men of the tribe, as well as three of the Puneaburu men, were captured

during the stay of the expedition in the neighbourhood. They are now undergoing sentence at Port Moresby, having had their queues cut off—this giving the authorities a hold over prisoners, as the possession of the hair is thought to give the possessor a power of bewitching the original owner. The party now proceeded eastward along the crest of the Puneaburu range, through frequent mist and rain. The whole country was forest-clad, involving incessant labour in cutting a track, while constant ascents and descents were necessary. The highest point reached was about 4500 feet above sea-level. On September 29 an open country was reached, and friendly relations established with a village of the Akaude tribe, who are at constant enmity with the Puneaburu and Dorevaida tribes, as well as their northern neighbours. It was found that the main water-parting had been crossed, the rivers now flowing north, apparently to the Musa, first explored by Sir W. Macgregor in 1895. Of these the Adau and Domara (both of which were heard of by Sir W. Macgregor as branches of the Musa) seem to unite to form the eastern branch of that river. A map, constructed by Captain Barton, accompanies the paper, and shows the Adaua as flowing south-west from the south side of Mount Suckling, and after traversing the Keveri valley, turning abruptly north through a deep gorge in the Mount Suckling range. This will not, therefore, constitute the main divide, as has hitherto been supposed. This is placed some 12 miles north of Cloudy bay, its elevation being here only 2300 feet. As before stated, however, the Puneaburu range, on which Mount Clarence is thought to lie, is considerably higher.

POLAR REGIONS.

Peary's Work in 1900 and 1901.—We have been favoured by the secretary of the Peary Arctic Club with copies of letters sent home last autumn by the explorer, describing in outline the operations of his expedition from May, 1900, to the date of the arrival of the *Eric* in the summer of 1901. On May 4, 1900, Peary, having sent back two natives he had with him from Cape Britannia (Cape North), continued along the Greenland coast with Henson and one Eskimo, reaching Lockwood's farthest on May 8, Cape Washington the next day, and the northern extremity of the land on May 13, in 83° 39′ N., 30° 20′ W. It was after the northward advance to 83° 50′ N. that the route was continued along the coast, the turning point being approximately in 83° N., 25° W., where dense fog, accompanied by a severe storm, made a further advance impossible. On the return open water was met with off various capes, rendering progress precarious at times. The animals shot or seen during the journey included musk-oxen, bears, a hare, a wolf, seals, and ptarmigan. Peary reached Fort Conger on June 10, and found that during his absence, Dr. Dedrich had secured a number of musk-oxen and seals, established caches, and brought up stores from the south. During the summer and autumn hunting was prosecuted in various directions, and was resumed again in the early part of 1901, much of the winter having been spent in igloos, built in the vicinity of the game killed in various localities. The start north was delayed, owing to the symptoms of anæmia manifested by all the party, and when, on April 5, Peary finally left Fort Conger with Henson and an Eskimo, it soon became evident that the condition of neither men nor dogs was such as to admit of a possibility of reaching the pole. Peary turned on reaching Lincoln bay, and having joined the rest of the expedition, the entire party moved south on April 17, soon getting news of the *Windward*, which Peary reached at Payer harbour on June 6. The ship was sawn free of the ice on July 3, and steamed across to Lyttelton island, afterwards proceeding to Whale sound before the arrival of the *Erik*. Peary hoped to explore the western side of Ellesmere Land during the autumn, and in the winter to collect a large quantity of dog-food at Cape D'Urville,

pushing on in the spring *viâ* Fort Conger to a point on the North Grinnel-land coast, and thence due north.

Proposed Expedition to the Northern Magnetic Pole.—An expedition is being organized in Christiania for the accurate determination of the present position of the northern magnetic pole, discovered by Sir James Ross in Boothia Felix in 1831. Its leader is to be Captain Roald Amundsen, who accompanied the Belgian Antarctic Expedition of 1897–99 as first officer, and is well qualified for the task by his training both as a seaman and as a magnetician. Last summer he made an experimental trip to the north in the Norwegian whaler *Gjöa*. It is uncertain whether the expedition will start during the present year or in 1903.

Arrival of the "Discovery" at Lyttelton, N.Z.—The arrival of the *Discovery* at Lyttelton, N.Z., at midnight, November 28, has been announced. The ship had entered the pack-ice in lat. 63·5°, long. 141° E., but pressure of time prevented a thorough investigation of the ice. Interesting collections have been made, and a party landed on Macquarie island for a few hours, obtaining some live penguins and their eggs, as well as some seals. The *Discovery* is said to have behaved admirably in rough weather. The small leak which had developed itself necessitated the ship's going into dry dock for caulking, but this proving ineffectual, the steel bow-plates were removed, and the cause of the leak discovered in some rivet holes which had been bored through the sheathing and planking. The defect has now been made good, and it was expected that the voyage would be continued on December 21. All on board were in excellent health and spirits.

The German Antarctic Expedition.—The *Times* correspondent at Cape Town announced the arrival there of the German antarctic ship *Gauss* on November 23. This date was, we believe, somewhat later than that put down in the programme of the voyage for arrival at Cape Town, but in spite of this the voyage seems to have been very successful, the soundings and other scientific observations having already given valuable results. On reaching the Cape Verde islands about the middle of September, Dr. von Drygalski despatched a first official report on the progress of the expedition to the Ministry of the Interior, and it has been since communicated to the public and printed in such journals as *Petermanns Mitteilungen* and the *Verhandlungen* of the Berlin Geographical Society. Down to the arrival at the Cape Verdes the weather had been entirely free from disturbances, and with the exception of a few hours near Madeira, the ship had proceeded under sail only. As a sailer the *Gauss* proved somewhat slower than had been hoped, even under a brisk breeze, 7 knots being the maximum speed yet attained. This may, it is thought, be due to the heavy load carried, and also to the fact that the hull had become somewhat foul. The ship left the Elbe on August 15, sighted Madeira on the 30th, but did not enter port, and dropped anchor in Porto Grande, São Vicente, on September 11. The scientific work commenced with the installation and testing of the various instruments. Successful soundings were carried out on the Josephine bank, giving as a result 487 metres (266 fathoms) in 37° 0′ N., 14° 4′ W., and 2490 metres (1361 fathoms) in 36° 42′ N., 14° 5′ W. Meteorological, physical, and biological observations had also been commenced, and the stay at Porto Grande was utilized for the careful determination of the amount of deviation on the *Gauss*, while a pendulum observation and geological and anthropometrical researches were carried out on shore. As regards the future work of the expedition, a third official statement has been issued in Germany, from which we gather the following additional details. It has been found necessary to charter a steamer to convey from Sydney to Kerguelen the dogs—procured at Vladivostok and presented to the expedition by a German commercial agent—the coal-supply (from New Zealand) to replenish

the stock consumed during the voyage out, and two scientific members of the Kerguelen scientific station. This vessel, which left Sydney on October 12, will await the arrival of the *Gauss* at Kerguelen and bring back the latest intelligence as to the course of the voyage. The work at the Kerguelen station will be carried on until March 1, 1903. International co-operation, especially in the matter of magnetic research, has been extended—beyond the share undertaken by the other antarctic expeditions—by the arrangement for observations, not only at the Argentine station on Staten island, but at other southern observatories, and even on ships making voyages beyond the 30th parallel. An important gap in the system has been filled by the establishment of a German station at Samoa. The observations will be continued from February 1, 1902, to March 1, 1903. The total estimated expense of the expedition has been considerably added to since the first estimate of £60,000 (apart from the Kerguelen station) was made. It is now reckoned at £75,000.

GENERAL.

The 'Geographical Teacher.'—The first number of the *Geographical Teacher*, the issue of which was recorded in the *Journal* for November, gives good promise that the magazine will prove of real value to the teachers of geography as a means of intercommunication for the exchange of ideas, and ventilation of difficulties met with in the work of improving the status of geographical education in this country. In an introductory statement explaining the objects held in view by its promoters, Mr. Freshfield once more dwells on the need that exists for such an improvement, though he sees encouraging signs that we are at last on the way to this end. Among the articles which deal with special aspects of geographical teaching, the following may be specially mentioned. Mr. T. G. Rooper describes in turn the various methods which have been introduced with success in Germany, all of which, he thinks, ought to be present to the mind in preparing the simplest course of lessons in geography. Mr. Andrews shows the use that may be made of maps for the purpose of correlating facts, the connection of which may not be obvious to the student at first sight, such as, *e.g.*, the rainfall of Africa and the main features of its vegetation. Dr. Herbertson insists on the importance of the study of the world as a whole as well as of the home district, pointing out the four principal distributions—configuration, climate, vegetation, and occupations of men, which must be studied in their broad outlines if geography is to be truly educative. An outline of the first of these distributions is given as a first instalment. Miss J. B. Reynolds discusses the objects to be aimed at in the organization of school excursions, and describes those which she has been able to carry out while teaching in an intermediate school at Cardiff, as well as one to the Lake District organized in 1900 in connection with the Girls' High School at Kendal. Mr. F. J. Wilkinson examines some recent examination papers in geography, and shows how far they still are from helping to call out the pupil's intelligence and reasoning powers, mere "memory questions" still forming a preponderating proportion of those set at such examinations as the Oxford and Cambridge Locals, that of the College of Preceptors, and the Military Entrance examination. This is sufficient to show that a good beginning has been made, and it is to be hoped, as Mr. Freshfield says, that the interest in the subject is sufficient to produce a body of capable contributors and interested readers such as may justify the continuance of the undertaking.

Formula for River-currents. Erratum.—In the note in the November number of the *Journal* on Herr Siedek's improved formula for the rate of currents in rivers, a mistake occurs in the fundamental equation for the speed of a normal stream. In the denominator of the fraction $\sqrt{B}$ should read $\sqrt[20]{B}$.

OBITUARY.

Edward John Eyre.

The last survivor of the intrepid band of explorers who, in the middle decades of the nineteenth century, began to throw light on the vast interior of the Australian continent has passed away in the person of Edward John Eyre, who died at Walreddon Manor, Tavistock, on November 30 last. Born in 1815, Mr. Eyre had reached the advanced age of eighty-six, and so long a time had passed since the date of the events which brought his name prominently before the public that many

EDWARD JOHN EYRE.

probably have been surprised to learn that the early Australian explorer had so far outlived all his contemporaries as to see the opening of the twentieth century. The latter years of his life had been spent in retirement at his country home in Devonshire.

Edward John Eyre was the son of the Rev. Anthony Eyre, a Yorkshire clergyman, and was educated at Louth and Sedbergh Grammar Schools. At the age of

seventeen he went out to seek his fortune in Australia, devoting himself first to sheep-farming in New South Wales, and afterwards to the transport of stock from that colony to the then newly opened tracts of South Australia. Here he settled for a time on the lower Murray river, at a period when the attention of the colonists was eagerly directed to the possibility of the existence of tracts of pastoral country beyond the inhospitable zone which bounded the Adelaide district on the north and west. It was imagined that a route might be discovered leading to the pastoral districts west of the Great Australian bight, the country bordering which was then absolutely unknown. Mr. Eyre, however, was of opinion that a search towards the north was more likely to lead to good results, and on being placed in command of an expedition (1840), his first efforts were directed to this quarter of the compass. They all proved fruitless, the advance being stopped by the desolate, mud-fringed shores of Lake Torrens, and the explorer determined to change his plans and make one more attempt in a westerly direction along the shore of the great bight. On this hazardous enterprise he was accompanied only by one other white—a faithful servant who had been his factotum on the expedition—and three native boys, the rest of the party being sent back to Adelaide.

The hardships encountered by Mr. Eyre in this first plunge into the unknown deserts between South and Western Australia have had few parallels in the history of exploration. Water was met with at rare intervals and small quantity among the sandhills which occasionally vary the desolate surface of the country, and the transport of the impedimenta across the wide intervening spaces was, in the enfeebled condition of the horses, almost beyond the powers of the small company. When little more than half the distance to King George's sound had been traversed, and the party was thus far from all hope of relief, a catastrophe occurred, which left the leader with one native boy and practically no resources, 600 miles from the nearest settlement. This was the murder of his white companion by two of the natives, and the desertion of these with the greater part of the supplies. For some time Mr. Eyre and his one companion pushed on, killing the horses at intervals and supporting themselves on the flesh, until at last providentially relieved by a French whaler, which happened to be cruising in the bight; the remainder of the route to King George's sound being then safely accomplished. An account of this and earlier journeys was given in the thirteenth volume of the Society's *Journal*, and more in detail in a work entitled 'Journals of Expeditions of Discovery into Central Australia and overland to King George's Sound in 1840–41.'

With this memorable journey Mr. Eyre's geographical work ceased, and the remainder of his career can only be briefly touched upon. After holding the post of resident magistrate and protector of natives on the Murray river for a time, he returned to England in 1845, and received various colonial appointments, ending with that of Governor of Jamaica in 1864. Into the history of the stormy events connected with his governorship we cannot enter. For his conduct in the suppression of the Negro insurrection he was, as is well known, brought to trial on his return to this country, but was acquitted by the Grand Jury, and retired on a pension in 1864. For his great Australian journey he had received the Founder's medal of our Society in 1843, and had been, since the death of Sir Henry Rawlinson, the oldest surviving recipient of the honour.

Dr. John Stopford Taylor.

Dr. J. S. Taylor, who died at his residence, 6, Grove Park, Lodge Lane, Liverpool, on November 11, 1901, in his eightieth year, was one of our oldest members, having joined the Society as far back as 1854. He had long been known and

respected in Liverpool, in which city he was formerly medical officer of health, and an ardent pioneer of sanitary reform. Although rarely able to attend its meetings, he took a warm interest in everything connected with the Society, though he had for some time been in failing health. For some years previous to 1875 he had represented St. Anne's Ward on the Liverpool City Council.

CORRESPONDENCE.

"Ancient" Geography.

In the latest edition of the Admiralty's 'South American Pilot,' part i., 1893, I find (p. 249) the following description of the most thickly populated, richest, most fertile and productive province of the Argentine Republic:—

"The south bank of the Rio de la Plata is low, uniform, and uncultivated; the only objects visible from the offing are groups of trees, which are scattered along the coast, rendering the navigation near it difficult. This coast is the termination of the pampas of Buenos Aires, immense, monotonous plains, resembling the deserts of Africa, which extend to the chain of the Cordilleras, 420 miles to the westward. The only vegetation is an occasional ombu tree, the only large tree which grows in the pampas; it attains a height of 40 to 50 feet. There is no water but that from the marshes, and the only occasional inhabitants are a miserable tribe of Indians, who sometimes visit the coast for pillage. The great quantity of salt which is everywhere found on the soil renders this country uninhabitable."

G. E. C.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1901-1902.

Second Ordinary Meeting, November 25, 1901.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS:—*Alexander V. Adiassewich; Captain Arthur Charles Aglionby, 3rd Batt. Connaught Rangers; John Gregory Apear; Frederick James Babb, B.Sc.; Robert Edward Bateman; T. A. V. Best, B.C.A. Administration; Neptune Blood; James D. Bourchier; Montgomerie Boyle; Rev. Frederick Brown; Captain Clarence Dalrymple Bruce, Duke of Wellington's Regiment; Alfred E. Carrier; Basil S. Cave, C.B.; David Paine Clark; Gerald C. Clark; Colonel J. Collinson, C.B., Northampton Regiment; Fergus Donovan; James H. Earls, M.D., L.S.A.; William Bateman Fairbairn; William Vere Reeve Fane; David Ferguson, M.I.M.E.; G. E. Franklin; Edward Wollaston Fritchley; Harry Bryant Green; William Hakes; R. W. Hamilton; Sydney Herbert; Lieut. Jessop Arthur Grey Hulton; Alleyne Ireland; T. N. Kelynack, M.D., M.R.C.P.; Arthur Barton Kent; Hermann Karl Wilhelm Kumm; Herbert Rowe Leetham; Major Leonard; Rev. Thomas Lewis; John Livingstone; R. Popham Lobb; Lionel William Lyde; Maurice Marsden; Alfred Ed. Woodley Mason; George Torrance Milne; Captain R. H. Monck-Mason, Royal Munster Fusiliers; Dr. E. Rice Morgan; Henry Melvil Napier; Anthony Nicholl; Alwyn Parker; W. Coulson Parkinson, L.C.C.; Robert Wm. Partridge; Jas. Bruce Pearson, Commr. B.I.S. Nav. Co.; Chas. Pobee; Hesketh Prichard; Cornelius Edward Probyn; Gilbert Purvis; Rev. Jno. Bremner Purvis; Alex. Hamilton Rice; Wm. Hugh Riley-Pearson;*

Robert Dawson Rudolf, M.D. Edin., M.R.C.P. Lond.; Captain Upton Ruxton; Harold Sessions, F.R.C.V.S., Veterinary Surgeon in employ of British War Office; Emilio Silvestri; Charles T. Spencer; James Stuart, M.A.; Captain F. A. Tighe, R.E.A.; Paul Robinson Tingley; Robert Woolley Walden; Gerard Anstruther Wathen, B.A.; Louis Webb; Dr. A. G. Welsford, M.D.; Alfred John West; Henry St. John Wileman; Herbert Williams; Rev. James Wolfenden, D.D.; Captain M. E. Willoughby, 2nd Bengal Lancers, D.A.A.G. Bengal Command; Sub-Lieut. Jno. George Wood, R.N.R., Navigating Officer, White Star Line; Percy Wyndham, B.A., Indian Civil Service.

HONORARY CORRESPONDING MEMBER.

Captain Ernesto de Vasconcellos (Secretary of the Geographical Society of Lisbon).

The Paper read was:—

"A Fourth Journey in Persia, 1897–1901." By Major Molesworth Sykes.

Dr. Vaughan Cornish exhibited a cinematograph representation of the Severn bore.

Third Ordinary Meeting, December 9, 1901.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Robert L. Barrett, B.A.; Clement Cyril Carter, B.A.; Rev. Eyre Chatterton; John Charles Codrington Coxhead; Robert Alexander Currie; Francis Druce, M.A., Oxon., F.R. Met. Soc.; Rev. George William Hanford, M.A. Camb.; Lieut.-Colonel J. Hayes-Sadler, H.B.M. Consul-General, Somaliland; Rev. J. Jeffrey Johnstone; Charles McKinnon; Mark F. Miller; Joseph J. Nunan; Colonel Gordon Ponsonby; Frederick Schlusser; Philip Hamelton Selby; Arthur Senior; Clarence Gilbert Wood.*

THE "DISCOVERY;" THE LATE EDWARD JOHN EYRE.

The PRESIDENT said: I think we must congratulate ourselves on the very successful voyage of the *Discovery*, which arrived at Lyttelton, New Zealand, ten days ago. She made up entirely for the loss of time in the Atlantic; for the *Discovery* is a ship for bad weather and heavy seas, and is not so well adapted for the calms of the equator and trade winds. She not only made a very rapid voyage, but also succeeded in taking deep-sea soundings and making a complete series of magnetic observations. Our explorers are now about to enter the Antarctic sea on a perilous but very important service. It only remains for us to send them out next summer a relief ship. This is absolutely necessary. It has been very hard work to collect the funds for it, and it is still hard work; but it has to be done, and I think I can promise you that it shall be done.

We must for one moment refer to the loss of the father of our Gold Medallists, the late Mr. Eyre, who died at a good old age. It was before most of us were born that the great Australian explorer made that wonderful journey from Adelaide to King George's Sound. It was only about three years ago that I received a letter from him, thanking me for the invitation to meet some of the premiers of the colonies—colonies which he once knew so well, and which still remember him; and it was only about a fortnight before he died that his wife sent us a photograph of our venerable Gold Medallist, who has now passed away at the age of eighty-six.

The Paper read was:—

"The Glaciers of Kangchenjunga." By Douglas W. Freshfield, Esq.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Is. = Isvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Adriatic Sea. *Vierteljahrshefte G. Unterricht* 1 (1901): 30-36. **Luksch.**
Das Seeboden-Relief des Adriatischen Meeres. Von Prof. J. Luksch. *With Map.*

Austria—Alps. *Vierteljahrshefte G. Unterricht* 1 (1901): 17-30. **Giannoni.**
Der historische Atlas der österreichischen Alpenländer und die Grundkartenfrage. Von Dr. C. Giannoni.

Austria—Dolomites. **Wundt.**
Engadin-Ortler-Dolomiten. Von Theodor und Maud Wundt. Zweite Auflage. Stuttgart: Greiner und Pfeiffer. (Not dated.) Size 11 × 7½, pp. 276. *Illustrations.*

One of the profusely illustrated records of mountain climbing occasionally issued under the auspices of the continental Alpine clubs.

Austria—Silesia. **Fox.**
Das Gesenke. Eine Passstudie. Von Dr. Robert Fox. Festschrift des Geograph. Seminars der Universität Breslau zur Begrüssung des XIII. Deutschen Geographentages. Pp. 178-189. Breslau, 1901. Size 9½ × 6½.

On a celebrated pass through the mountains of Silesia.

Austria—Vienna. **Hann.**
Die Meteorologie von Wien nach den Beobachtungen an der K. K. Meteorologischen Central-Anstalt 1852-1900. Von Julius Hann. Wein, 1901. Size 12½ × 9½, pp. 62.

Danube—Iron Gate. **Eyth.**
XVII.—XIX. Jahresb. (1898-1900) *Württemberg. V. Handelsg.* (1901): 3-31.
Die Sprengung des Eisernen Thors und die freie Donauschiffahrt. Von M. v. Eyth.

Europe—Military Geography. **Dentzer.**
Topographie der Feldzüge Robert Guiscards gegen das byzantinische Reich. Von Dr. Bernhard Dentzer. Festschrift des Geograph. Seminars der Universität Breslau zur Begrüssung des XIII. Deutschen Geographentages. Pp. 82-121. Breslau, 1901. Size 9½ × 6½.

The campaign was undertaken in the year 1081.

Switzerland. *Jahrb. Schweiz. Alpenclub.* 36 (1900–1901): 210–232. **Dübi.**
Bergreisen und Bergsteigen in der Schweiz vor dem 19. Jahrhundert. Von Dr. H. Dübi. *With Illustrations.*

Switzerland. *Le Globe, B.S.G. Genève* 40 (1901): 117–134. **Schenk.**
Les populations primitives de la Suisse. Par M. le Dr. Alex. Schenk.

Switzerland—Anthropology. *B.S. Neuchateloise G.* 13 (1901): 5–52. **Schenk.**
Matériaux pour l'anthropologie des populations primitives de la Suisse. Par le Dr. Alexandre Schenk. *With Illustrations.*

Switzerland—Geneva. **Pidoux.**
Mém. S. Phys. et d'Hist. Nat. Genève 33, No. 3 (1900): pp. 68.
Mémoire sur la latitude de l'Observatoire de Genève. Par Justin Pidoux.

Switzerland—Glacier-burst. *G.Z.* 7 (1901): 459–461. **Richter.**
Der Gletscohersturz von Simpeln am 19. März 1901. Von E. Richter.

Switzerland—Lake of Geneva. *Le Globe, B.S.G. Genève* 40 (1901): 113–117. **Forel.**
Les seiches de Genève. Par M. le prof. Dr. F. A. Forel. (*Résumé.*)

Switzerland—Map. *Le Globe, Mem. S.G. Genève* 40 (1901): 55–71. **Lochmann.**
La nouvelle carte murale de la Suisse pour les écoles. Par le Colonel J. J. Lochmann.

Turkey—Macedonia. *Izvestiya Imp. Russ. G.S.* 37 (1901): 79–131. **Bashmakov.**
A Journey in Macedonia. By A. A. Bashmakov. *With Map.* [In Russian.]

United Kingdom—Forestry. *Nineteenth Century* 50 (1901): 564–578. **Maxwell.**
The Sad Plight of British Forestry. By the Right Hon. Sir Herbert Maxwell.

United Kingdom—Ireland—Botany. **Praeger.**
P.R. Irish A. 7 (1901): pp. clxxxviii. and 410.
Irish Topographical Botany. Compiled by R. L. Praeger. *With Maps.*
This will be the subject of a note.

United Kingdom—Lake District. **Bradley.**
"Highways and Byways in the Lake District." By A. G. Bradley, with Illustrations by Joseph Pennell. London: Macmillan & Co., 1901. Size 8 × 5½, pp. xii. and 332. *Map and Illustrations. Price 6s. Presented by the Publishers.*

This work is concerned rather with the highways than the byways of the Lake District, and includes within its purview much of the outlying country not usually embraced under that designation. Historical reminiscences and sketches of the life of the people form a great part of the volume. The author is no doubt right in supposing that by devoting his attention wholly to the scenic beauties of the district, he would fail in producing a readable volume, but it may be perhaps thought that he has fallen into the opposite error, and been too chary in his descriptions of the romantic recesses of dale and mountain, an adequate knowledge of which cannot be gained without leaving the highways. The illustrations give somewhat free renderings of the scenes depicted, which it would be sometimes hard to identify from them.

United Kingdom—Lancashire. **Tiddeman.**
P. Yorkshire Geolog. and Polytechnic S. 14 (1901): 178–182.
Notes on the Geology of Clitheroe and Pendle Hill. By R. H. Tiddeman.

United Kingdom—Scotland. *Scottish G. Mag.* 17 (1901): 399–414. **Cash.**
The First Topographical Survey of Scotland. By C. G. Cash.
This is the subject of a note in the *Journal* for December.

United Kingdom—Tide Tables. **Harris and Havergal.**
Tide Tables for the British and Irish Ports for the year 1902: also the times and heights of high water at full and change for the principal places of the globe. By Captain H. R. Harris, R.N., and Commander A. Havergal, R.N. London: J. L. Potter. Size 10 × 6. *Presented by the Hydrographer.*

United Kingdom—Yorkshire. **Baddeley.**
Thorough Guide Series. Yorkshire (Part ii.). West and part of North Ridings and all parts of the country west of the N.E. Main Line, also Barnard Castle and Teesdale. By M. J. B. Baddeley, B.A. Fourth Edition. London: Dulau & Co.,

1901. Size 6½ × 4½, pp. xvi. and 152. *Maps and Plans. Price 3s. Presented by the Publishers.*

This excellent guide has been further improved in the present edition by the addition of contoured maps, on the scale of ½ inch to a mile, of the chief tourist parts of Wharfedale, Wensleydale, and Swaledale.

United Kingdom—Yorkshire. **Hughes.**

P. Yorkshire Geolog. and Polytechnic S. 14 (1901): 125–150.

Ingleborough. Part. i. Physical Geography. By Prof. T. McK. Hughes. *With Illustrations.*

United Kingdom—Yorkshire. **Monckman.**

P. Yorkshire Geolog. and Polytechnic S. 14 (1901): 151–158.

The glacial Geology of Bradford, and the Evidence obtained from Recent Excavations of a Limestone Track on the South Side of the Valley. By James Monckman, D.SC. *With Map.*

ASIA.

Asia—Travel. **Cotes.**

Westward from the Golden Gate. By Annie Russell Cotes. London: printed by W. H. and L. Collingridge. (Not dated.) Size 9 × 7½, pp. 160. *Maps and Illustrations. Presented by the Author.*

The privately printed account of a tour in 1885–86 round Eastern and Southern Asia, dealing principally with Japan, Hong-kong, Ceylon, and India.

Ceylon. **Ferguson.**

The Ceylon Handbook and Directory and Compendium of Useful Information, to which is prefixed a Review of the Planting Enterprise and Agriculture of the Colony; with Statistical Information referring to the Planting Enterprise in other countries. Compiled and edited by J. Ferguson. Colombo: A. M. & J. Ferguson, 1901. Size 8½ × 5½, pp. lxvi. and 1404. *Map, Plan, and Illustrations. Presented by the Compiler.*

Ceylon. *Quart. J. Geol. Soc.* 57 (1901): 198–209. **Parkinson.**

Notes on the Geology of South-Central Ceylon. By John Parkinson. Size 8½ × 5½. *Sketch-map and Illustrations. Also separate copy, presented by the Author.*

China. **Kopsch.**

Britain's Trade with China. By H. Kopsch. (From the *Empire Review*, September, 1901, pp. 236–252.) Size 10 × 6½. *Presented by the Author.*

China. **Parker.**

John Chinaman and a few others. By E. H. Parker. London: John Murray, 1901. Size 8½ × 5½, pp. xx. and 380. *Illustrations. Price 8s. net. Presented by the Publisher.*

A series of vivid sketches of Chinese character, drawn from the writer's personal experience gained during his long period of consular service. The book deserves to be read by all responsible in any way for the direction of European relations with China. It sheds a valuable light on Chinese methods and modes of thought, a failure to recognize and make allowance for which may have, the author thinks, disastrous consequences.

Malay States—Negri Sembilan. **Campbell.**

Federated Malay States. Annual Report on the State of Negri Sembilan for the year 1900. By D. G. Campbell. Kuala Lumpur, 1901. Size 13½ × 8½, pp. 10 and xxii.

Coffee-growers had to contend against low prices and a plague of caterpillars, and the rice crop was generally poor. The value of tin exported was some 25 per cent. higher than in 1899.

Malay States—Pahang. **Clifford.**

Federated Malay States. Annual Report of the State of Pahang for the year 1900. By Hugh Clifford. Kuala Lumpur: 1901. Size 13½ × 8½, pp. 22 and xx.

The mining results in 1900 are said to be not encouraging, any development of the country from this point of view requiring European capital.

Malay States—Perak. **Walker.**

Perak Administration Report for the year 1900. By Colonel R. S. F. Walker, C.M.G. Taiping. Size 13 × 8½, pp. 64. *Diagram.*

Malay States—Selangor. **Belfield.**
Selangor Administration Report for the year 1900. By H. Conway Belfield. Kuala Lumpur, 1901. Size 13½ × 8½, pp. 24 and xxxiv.

Persia—Azerbaijan. **Wood.**
Trade of Azerbaijan for the year 1900. Foreign Office, Annual No. 2685, 1901. Size 9½ × 6, pp. 20. *Diagram. Price* 4½*d.*

Philippine Islands. ———
Special Report of the United States Board on Geographic names relating to the Geographic Names in the Philippine Islands. Washington: 1901. Size 9 × 6, pp. 60.

[See note in the Monthly Record for December (p. 620).]

Red Sea. *Deutsche Kolonialzeitung* 18 (1901): 350–351. **Bruchhausen.**
Eine deutsche Kohlenstation im Roten Meere. Von Major Karl von Bruchhausen. *With Maps.*

On the coaling-station lately established on the island of Kumh, in the Farsan group.

Russia—Siberia. *National G. Mag.* 12 (1901): 317–324. **Grosvenor.**
Siberia. By Prof. Edwin Grosvenor.

The writer draws a vivid picture of the part which, in his opinion, Siberia is to play in the future.

Russian Central Asia. *Zemlevedenie* 8 (1901): 1–26. **Bogoyavlensky.**
The Upper Amu Darya. By N. Bogoyavlensky. *With Illustrations.*

A note on this paper was given in the December number (vol. xviii. p. 618).

Siam—Bangkok. **Carlisle.**
Trade of Consular District of Bangkok for the year 1900. Foreign Office, Annual No. 2705, 1901. Size 9½ × 6, pp. 16. *Price* 1*d.*

Siam—Chiengmai. **Beckett.**
Trade of Chiengmai for the year 1900. Foreign Office, Annual No. 2717, 1901. Size 9½ × 6, pp. 14. *Price* 1*d.*

Siam—Nan. **Lyle.**
Trade of Nan for the year 1900. Foreign Office, Annual No. 2720, 1901. Size 9½ × 6, pp. 8. *Price* ½*d.*

Turkey—Armenia. **Belck.**
Jahresb. Frankfurter V. G. u. Statistik 64 *and* 65 (1899-1901): 127–137.
Armenien im Altertum und in der Jetztzeit. Von Dr. Waldemar Belck.

Turkey—Baghdad. **Melvill.**
Trade of Baghdad for the year 1900. Foreign Office, Annual No. 2707, 1901. Size 9½ × 9. *Price* ½*d.*

Turkey—Harpoot. *Monthly Weather Rev.* 29 (1901): 250–253. **Huntingdon.**
The climate of Harpoot, Turkey in Asia. By Prof. Ellsworth Huntingdon.

Turkey—Kurdistan. **Maunsell.**
Central Kurdistan. By Major F. R. Maunsell. (From the *Geographical Journal* for August, 1901.) Size 10 × 6½, pp. 24. *Map.*

AFRICA.

Canary Islands—Historical. **Müller.**
Die Kunde des Altertums von den Canarischen Inseln. Von Curt Müller.—Festschrift des Geograph. Seminars der Universität Breslau zur Begrüssung des XIII. Deutschen Geographentages. Pp. 38–64. *Sketch-map.* Breslau, 1901. Size 9½ × 6½.

Cape Colony. *Fortnightly Rev.* 70 (1901): 213–221. **Firth.**
The Albany Settlement. By J. B. Firth.

A sketch of the origin and history of the experiment at colonization made at Albany eighty years ago.

Cape Colony. *T.S. African Philosoph. S.* 11 (1901): 161–168. **Marloth.**

Notes on the Occurrence of Alpine Types in the Vegetation of the Higher Peaks of the South-Western Region of the Cape. By R. Marloth, PH.D. *With Plates.*

On five peaks with an altitude exceeding 6000 feet (at which height the alpine types first begin to appear) the writer gathered seventy-two species of plants, a list of which is given.

German South-West Africa. **Düttmann.**

Beiträge Kolonialpolitik 2 (1900–1901): 612–616.

Kurze Reiseerinnerungen aus dem Nordwesten Deutsch-Südwest-Afrikas, und dem südlichen Angola. Von E. Düttmann.

Gold Coast. *B.S. Neuchateloise G.* 13 (1901): 148–154. **Perregaux.**

La Côte d'Or comme pays aurifère. Par E. Perregaux.

Kamerun. *Beiträge Kolonialpolitik* 3 (1901–1902): 138–148. **Spellenberg.**

Bericht über meine dritte Reise ins N.-W.-Gebiet des Hinterlandes von Kamerun. Von G. Spellenberg.

The author is a missionary who in 1900 pushed beyond the headwaters of the Mungo to the northern border of the Bakundu country, returning to the coast by a new route west of the Kamerun peak, of which the complete circuit was finally made.

Kamerun. *Deutsch. Kolonialblatt* 12 (1901): 595–597. ——

Bereisung des Gebietes südlich und südöstlich von Joko. *With Sketch-Map.*

Adds somewhat to our knowledge of the Upper Sanaga basin.

Madeira. **Biddle.**

The Land of the Wine, being an account of the Madeira Islands, at the beginning of the Twentieth Century, and from a new point of view. By A. J. Drexel Biddle. 2 vols. Vol. i. Comprising the History of the Madeiras; information for the Traveller and Visitor, and a Treatise on the Geography, Geology, and Climate. Vol. ii. Treating of the Natives, their characteristics, religion, laws, and customs; the Commerce; the Flora; the Vine and the Wine; and the Fauna. London, etc.: Drexel Biddle, 1901. Size 9 × 6, pp. (vol. i.) 268; (vol. ii.) 300. *Maps and Illustrations. Presented by the Author.*

A large amount of information is presented in these volumes, but no attempt has been made to weave it into a connected narrative. The second volume is avowedly devoted to more technical questions, but the first also is rather too much a congeries of isolated facts. What the new point of view is does not appear, unless it be that, in the author's opinion, Madeiran history has hitherto been regarded in too close association with that of Portugal. As a work of reference the book may be useful, and it is illustrated by some excellent reproductions of photographs.

Madeira and Canary Islands, etc. **Brown.**

Madeira and the Canary Islands with the Azores. A Practical and Complete Guide for the use of Invalids and Tourists, with Twenty Coloured Maps and Plans and numerous Sectional and other Diagrams. By A. Samler Brown. Sixth edition. London: Low & Co., 1901. Size 7½ × 5, pp. xviii. and 339. *Price 2s. 6d. Presented by the Publishers.*

Besides being brought generally up to date, this useful guide has been extended, in the present edition, by the addition of a section on the Azores.

Morocco. *Jahresb. Frankfurter V.G. u. Statistik* 64 *and* 65 (1899–1901): 5–88. **Arnold.**

Vier Karten und Studien zur Wirthschafts-geographie von Marokko. Von Dr. R. Arnold. *With Maps.*

Morocco. *Monthly Rev.* 5 (1901): 89–102. **Bishop.**

Notes on Morocco. By Isabella L. Bishop.

Morocco. **Meakin.**

The Land of the Moors. A Comprehensive Description. By Budgett Meakin. London: Sonnenschein & Co., 1901. Size 9 × 6, pp. xxxii. and 464. *Map and Illustrations. Presented by the Publishers.*

This will be specially noticed.

Natal. **Gray.**

Report on the Mining Industry of Natal for the year 1900. By G. J. Gray, Pietermaritzburg, 1901. Size 13½ × 8½, pp. 72. *Maps and Sections.*

North Africa. *Blackwood's Mag.* **170** (1901): 545–558. **Harris.**
The Moslem Confraternities of North Africa. By Walter B. Harris.

Portuguese East Africa. *B.S.G. Lisboa* **17** (1898–1899): 583–589. **Costa.**
Notas para o Diccionario Chorographico da Provincia de Moçambique por Gomes da Costa.

Notes on places and physical features in Mozambique.

Portuguese East Africa—Historical. **Liengme.**
B.S. Neuchateloise G. 13 (1901): 99–135.
Un potentat africain: Goungounyane et son règne. Par le Dr. Liengme. *With Illustrations.*

Sahara. *C. Rd.* **133** (1901): 349–351. **Collot.**
Goniatites carbonifères dans le Sahara. Note de M. Collot.

The fossils here described were found between Figuig and Igli.

St. Helena. **Sterndale.**
St. Helena. Report for 1900. Colonial Reports, Annual No. 323, 1901. Size 9½ × 6, pp. 18. *Price* 1½*d.*

Somaliland. *P. Zoolog. S.* 1901 (vol. ii.): 298–316. **Sharpe.**
On a Collection of Birds made by Dr. Donaldson Smith in Northern Somaliland. By R. Bowdler Sharpe, LL.D.

South Africa. *J.R. United Service I.* **45** (1901): 948–961. **Zietsman.**
The Native Question in South Africa. By the Hon. L. Zietsman.

South Africa—Historical. *Nineteenth Century* **50** (1901): 402–416. **Wirgman.**
The First British Settlers in South Africa. By the Rev. Dr. Wirgman.

Tunis. *B.S. Languedoc. G.* **23** (1900): 274–290; **24** (1901): 26–41. **Bordier.**
La Tunisie en 1900. Par le Commandant Désiré Bordier. *With Illustrations.*

Tunis. *B.S.G. Com. Havre* **18** (1901): 340–349. **Menager.**
La Politique Coloniale. L'invasion sicilienne en Tunisie. Par E. Menager.

Translation of an article in an Italian paper.

Uganda—Mammals. *P. Zoolog. S.* 1901 (vol. ii.): 85–90. **Thomas.**
On the more notable Mammals obtained by Sir Harry Johnston in the Uganda Protectorate. By Oldfield Thomas. *With Plate.*

West Africa. **Alldridge.**
The Sherbro and its Hinterland. By T. J. Alldridge. London: Macmillan & Co., 1901. Size 9 × 6, pp. xvi. and 356. *Map and Illustrations. Price* 15*s. net. Two copies, one presented by the Author, the other by the Publishers.*

This will be specially noticed.

West Africa—Climate. *Climate* 3 (1901): 20–25. **Harford-Battersby.**
The West African Climate. By the Editor. *With Illustrations.*

Zanzibar. **Cave.**
Trade of Zanzibar for the year 1900. Foreign Office, Annual No. 2718, 1901. Size 9½ × 6, pp. 22. *Price* 1½*d.*

NORTH AMERICA.

Alaska—Willows. *P. Washington A. Sci.* 3 (1901): 297–362. **Coville.**
Papers from the Harriman Alaska Expedition. XXIV. The Willows of Alaska. By Frederick V. Coville. *With Plates.*

Alaska and the Yellowstone. **Taylor.**
Touring Alaska and the Yellowstone. By Charles M. Taylor, jun. Philadelphia: George W. Jacobs & Co., 1901. Size 8 × 5½, pp. 388. *Illustrations. Price* $1.60 *net. Presented by the Author.*

Mr. Taylor is well known as the author of various brightly written sketches of travel of a popular character. The present work gives a good idea of the nature of the Alaskan coast-region, including the White Pass route to Lake Bennett, besides describing the route across Canada, and a visit to the Yellowstone. The book is tastefully got up, and its size has wisely been kept within unpretentious limits.

America—Name. *Riv. G. Italiana* 8 (1901): 555–571. **Rambaldi.**
Per la storia del nome "America." Nota del Prof. P. L. Rambaldi.

United States—Maryland. ——
Maryland and its Natural Resources. Prepared by the Maryland Geological Survey. Wm. Bullock Clark, State Geologist. Official Publication of the Maryland Commissioners, Pan-American Exposition. Baltimore, 1901. Size 9 × 6. *With Map.*

United States—Trade. **Hitchcock.**
Distribution of the Agricultural Exports of the United States. 1894–1898. By Frank H. Hitchcock. Washington, 1899. Pp. 154. Agricultural Exports of the United States by Countries, 1895–1899. By the same. Washington, 1900. Pp. 88. Agricultural Imports of the United States by Countries, 1895–1899. By the same. Washington, 1900. Pp. 74. (U.S. Department of Agriculture, Bulletins 16, 20, 21.) Size 9 × 6. *Presented by the U.S. Department of Agriculture.*

CENTRAL AND SOUTH AMERICA.

Bolivia. **Church.**
Northern Bolivia and President Pando's New Map. By Colonel George Earl Church. (From the *Geogr. Journal* for August, 1901.) Size 10 × 6½, pp. 10. *Map.*

Brazil. *Meteorolog. Z.* 18 (1901): 385–405. **Draenert.**
Das Höhenklima von Uberaba, Central-Brasilien. Von Prof. F. M. Draenert.

Brazil. *Globus* 80 (1901): 242–243. **Schulze.**
Die erste ethnographische Skizze über die Botokuden in deutscher Sprache. Von Franz Schulze.

On the account by one of Cabral's companions, which was translated through Italian into German, appearing in 1508 in the collection of Jobst Ruchamer.

Brazil—Amazon. **Todd.**
Beiträge Kolonialpolitik 3 (1901–1902): 11–22, 51–59.
Die Reise des amerikanischen Kanonenbootes Wilmington auf dem Amazonenstrom. Amtlicher Bericht des Kapitäns Z. D. Todd. *With Illustrations.*

Translation of the original report. The voyage was alluded to in vol. xiv. of the *Journal* (p. 567).

Brazil—Bibliography. **Phillips.**
A List of Books, Magazine Articles, and Maps relating to Brazil. 1800–1900. Prepared by P. Lee Phillips. A Supplement to the Handbook of Brazil (1901), compiled by the Bureau of the American Republics. Washington, 1901. Size 9¼ × 6, pp. 146. *Presented by the Compiler.*

A useful compilation, though some important omissions occur. Thus Dr. Crevaux's name does not appear at all, and M. Coudreau's latest work, on the Trombetas, is not entered. The separation of books from articles in periodicals seems unnecessary, and in the absence of distinctive headlines is likely to cause confusion.

Brazil—Rio Grande do Sul. **Staniforth.**
Trade of Consular District of Rio Grande do Sul for the years 1899 and 1900. Foreign Office, Annual No. 2702, 1901. Size 9¾ × 6, pp. 16. *Diagram. Price 3d.*

Brazil and Argentine Republic. ——
Homenaje al Presidente Dr. Campos Salles. El Brasil y la Argentina. Confraternidad Sud-Americana. Buenos Aires, 1901. Size 12½ × 9, pp. xviii. and 462. *Illustrations. Presented by Dr. F. P. Moreno.*

Official account of a visit to Brazil by the Argentine President in 1899, and of the return visit of the Brazilian President in 1900. It contains a number of photographic illustrations of the cities of Buenos Aires and Rio Janeiro.

Chile. *Meteorolog. Z.* 18 (1901): 406–412. **Martin.**
Der Regen in Südchile. Von Dr. K. Martin.

Chile—Frontier Question. **Figueroa.**
El Problema de nuestras Fronteras del Norte. Tacna y Arica. Por Pedro Pablo Figueroa. Santiago de Chile, 1900. Size 8½ × 5½, pp. 30.

Costa Rica and Columbia. *B.I. Fis.-G. Costa Rica* 1 (1901): 135–145. ——
Los "Geographiche Mitteilungen," y la frontera entre Costa Rica y Colombia.

The writer criticizes the views of Prof. Seler expressed in his article in *Petermanns*

Mitteilungen, and gives a map on which the frontier is drawn more to the benefit of Costa Rica. It is difficult, however, to reconcile the boundary-line here drawn with the natural interpretation of the award (see note, *ante*, p. 93).

Cuba **Carden.**

Trade of the Island of Cuba for the year 1900. Foreign Office, Annual No. 2674, 1901. Size 9½ × 6, pp. 38. *Price 2½d.*

Although the year 1900 was marked by much commercial depression, signs of improvement are said to be everywhere visible.

French Guiana. **Hoarau-Desruisseaux.**

Ministère des Colonies, Feuille de Renseignements l'Office Colon. 3 (1901): 3–4.

Les Mines et l'Industrie minière de la Guyane française. Rapport de M. l'Inspecteur des colonies Hoarau-Desruisseaux.

Leeward Islands. *Monthly Weather Rev.* 29 (1901): 254–256. **Alexander.**

Insolation and Rainfall in the Leeward Islands. By W. H. Alexander. *With Sketch map.*

Panama Canal. *P.I. Civil Engineers* 144 (1901): 150–214. **Ford.**

The Present Condition and Prospects of the Panama Canal Works. By J. T. Ford. *With Map and Sections.*

The author takes a sanguine view of the prospects of the canal operations.

Paraguay. **Bolland.**

Exploraciones practicadas en el Alto Paraguay y en la Laguna Gaiba por el capitán de marina Enrique Bolland. Fundación de un Puerto. Buenos Aires, 1901. Size 10½ × 7, pp. 144. *Maps and Illustrations.*

This will be the subject of a notice.

Turks and Caicos Islands. **St. Aubyn.**

Turks and Caicos Islands. Report for 1900. Colonial Reports, Annual No. 328, 1901. Size 9½ × 6, pp. 22. *Price 1½d.*

POLAR REGIONS.

Arctic—Position-finding. *Blackwood's Mag.* 170 (1901): 476–483. ———

Finding the Way to the Pole.

On the difficulties in the way of determining the position in the arctic, with special reference to Nansen's expedition.

Spitsbergen. **Römer.**

Jahresb. Frankfurter V.G. u. Statistik 64 *and* 65 (1899–1901): 160–163.

Auf einem deutschen Fischdampfer um Spitsbergen und König-Karlsland. Von Dr. F. Romer.

Spitsbergen—King Charles' Land. **Nathorst.**

Bidrag till Kung Karls lands geologi. Af A. G. Nathorst. (Geol. Fören. Förhandl., No. 208, Bd. 23, Häft 5, pp. 341–378.) *Maps and Illustrations. Presented by the Author.*

Based on the results of the author's expedition of 1898.

MATHEMATICAL GEOGRAPHY.

Astronomy. ———

Tychonis Brahe Dani die XXIV. Octobris A.D. MDCI defuncti, operum primitias de Nova Stella summi civis memor denuo edidit Regia Societas Scientiarum Danica. Hauniæ, 1901. Size 10½ × 8. *Presented by the Royal Danish Society of Sciences.*

Astronomy. **Zhdanko.**

Tables of the Corrected Azimuths of the Sun (in Continuation of Bardwood's Tables). (In Russian.) St. Petersburg, 1900. Size 9½ × 7, pp. vi. and 182.

Compass-deviations. **Evans and Smith.**

Admiralty Manual for the Deviations of the Compass. Originally edited in 1862 by F. J. Evans and Archibald Smith. Seventh Edition. London: J. D. Potter, 1901. Size 10 × 6, pp. x. and 212. *Diagrams. Price 3s. Presented by the Hydrographer, Admiralty.*

Geodesy. *C. Rd.* 133 (1901): 607–613, 666–670. **Hatt.**

Jonction d'un réseau fermé de triangulation. Note de M. P. Hatt.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geomorphology. *Science* 14 (1901): 184–185. **Branner.**
The Origin of Travertine Falls and Reefs. By Prof. J. C. Branner.

Glaciers. *Nature* 64 (1901): 399–400. **Buchanan.**
The Size of the Ice-grain in Glaciers. By J. Y. Buchanan.

Glaciers. **Rabot.**
Les variations de longueur des glaciers dans les régions arctiques et boréales Par Charles Rabot. (Extrait des *Archives des sciences physiques et naturelles*, Annés 1899 et 1900.) Genève et Bale, Georg & Co., 1900. Size 9½ × 6½, pp. 250.

Meteorology—Atlantic. **Knipping.**
Sturmtabellen für den Atlantischen Ozean. Von E. Knipping. Beiheft I. zu den Annalen der Hydrographie und Maritimen Meteorologie, Heft VIII. (August), 1901. Berlin: E. S. Mittler und Sohn. Size 10½ × 7½, pp. 20. *Diagrams.*

Meteorology—Auroras. *C. Rd.* 133 (1901): 279–281. **Stassano.**
Démonstration géographique de l'origine terrestre des aurores polaires. Note de M. Henri Stassano.

Meteorology—Föhn. **Höfler.**
Jahresb. Frankfurter V.G. u. Statistik 64 *and* 65 (1899–1901): 145–150.
Die Entstehung des Föhns. Von Prof. Dr. Höfler.

Methods of Observation. **Buchanan.**
Chemical and Physical Notes. By J. Y. Buchanan. Reprinted from 'The Antarctic Manual,' 1901, chapter ix. pp. 71–175. *With Illustration.* Size 9 × 6, pp. 107. London, 1901.

Mountain-building. *Deutsche Rundschau G.* 24 (1901): 1–10. **Müller.**
Die Schrumpfungstheorie im Lichte der Kritik. Von P. Johannes Müller.

Mountains. *Scottish G. Mag.* 17 (1901): 449–459. **Geikie.**
Mountains. By Prof. James Geikie, F.R.S. *With Sections.*

Describes the different types of mountain structure.

Oceanography. *B.S.G. Comm. Bordeaux* 27 (1901): 34–40, 55–61, 69–77. **Thoulet.**
Conférence internationale pour l'étude de la mer, Stockholm, 1899. Par M. J. Thoulet. *With Sketch-maps.*

Oceanography—Currents. *National G. Mag.* 12 (1901): 337–339. **Page.**
The Drift of Floating Bottles in the Pacific Ocean. By James Page.

Oceanography—Methods. *La G., B.S.G. Paris* 4 (1901): 168–171. **Gasnier.**
Thermomètres électriques de profondeur. Par P. Gasnier.

Oceanography—North Atlantic. **Antze.**
Revision der Oberflächenströmungen des nordatlantischen Ozeans auf Grund der Triftphänomene. Inaugural-Dissertation zur Erlangung der Doktorwürde der hohen philosophischen Fakultät der Christian-Albrechts-Universität in Kiel vorgelegt von Gustav Antze. Minden i. W., J. C. C. Bruns, 1901. Size 10 × 6½, pp. 48. *Charts.*

Oceanography—Red Sea. **Pott.**
Berichte der Commission für Oceanographische Forschungen. Expedition S. M. Schiff "Pola" in das Rothe Meer. Südliche Hälfte (September 1897—März 1898). Beschreibender Theil, verfasst von Paul Edler von Pott. Wien, 1899. Size 12 × 9½, pp. 54. *Map and Plates.*

Physical Geography. *Science* 14 (1901): 205–210. **Norton.**
The Relation of Physical Geography to other science subjects. By W. H. Norton.

A lucid exposition of the true position of physical geography as a science, the principal aim of which is the study of land-forms.

Physical Geography. **Suess.**
Das Antlitz der Erde. Von Eduard Suess. Dritter Band, Erste Hälfte. Wien, [&c.]: F. Tempsky, 1901. Size 11 × 8, pp. iv. and 508. *Maps and Illustrations.* *Price* 25*s. net.*

This will be specially reviewed.

Terrestrial Magnetism. *Terrestrial Magnetism* 6 (1901): 73–75. **Bauer.**
Note on the Secular Motion of the Earth's Mean Magnetic Axis. By L. A. Bauer.

Weather Prediction. *Climat* (1901): 171–180. **Wölffing.**
On the Possibility of Weather Prediction for a Long Time Ahead. By Prof. Dr. E. Wölffing.

Zoogeography. *P. Zoolog. S.* 1 (1901): 372–394. **Jameson.**
On the Identity and Distribution of the Mother-of-Pearl Oysters; with a Revision of the Subgenus *Margaritifera*. By H. Lyster Jameson, B.A., PH.D. *Illustrations.*

BIOGRAPHY.

Orléans. *Questions Dipl. et Colon.* 12 (1901): 231–233. **De la Panouse.**
Henri d'Orléans. Par Colonel de la Panouse.

Smith. **Dickson.**
The life of Major-General Sir Robert Murdoch Smith, K.C.M.G. By his Son-in-Law, William Kirk Dickson. Edinburgh & London: William Blackwood & Sons, 1901. Size 9 × 6, pp. xii. and 376. *Portraits, Maps, and Illustrations. Price* 15*s. net. Presented by the Publishers.*

This life of Sir R. Murdoch Smith presents a very clear view of the many-sided work accomplished by the deceased general during his active life. The principal attention is devoted to his services in the field of archæological exploration and the opening of the great Indo-European telegraph route. The great value of the latter, not only to Europe, but to Persia itself, has long been fully recognized, and lends a special interest to the record of Murdoch Smith's labours towards its accomplishment.

Venukoff. *Deutsche Rundschau G.* 24 (1901): 42–43. **Stenin.**
Generalmajor M. I. Wenjukoff. Von P. v. Stenin. *With Portrait.*

GENERAL.

Comparative Geography. *Riv. G. Italiana* 8 (1901): 481–495. **Porena.**
A proposito di un recente articolo "sulla Geographia comparata secondo il Ritter e il Peschel." Nota del Prof. Filippo Porena.

Education. *G. Teacher* 1 (1901): 10–13. **Bird.**
Limitations and Possibilities of Geographical Teaching in Day Schools. By C. Bird.

Geographical Science. *National G. Mag.* 12 (1901): 324–337. **Genthe.**
German Geographers and German Geography. By Martha Krug Genthe, PH.D.

An account of some of the most famous German geographers from Behaim to Ratzel, and of the modern development of Geographical science. The authoress unhesitatingly classes Mercator as a German, and gives the name of Apianus as Bennewitz (for Bienewitz).

German Colonies. *Beiträge Kolonialpolitik* 3 (1901–1902): 23–32. **Dove.**
Meteorologische Beobachtungen aus den Deutschen Schutzgebieten. Von Prof. Dr. K. Dove.

German Colonies. *Beiträge Kolonialpolitik* 3 (1901–1902): 1–9, 41–50. **Hillemanns.**
Unsere Kolonien im Jahre 1900. Von Dr. Hillemanns.

Malaria. *Questions Dipl. et Colon.* 12 (1901): 333–348. **Dantec.**
Le paludisme, sa prophlylaxie. Par Dr. Le Dantec. *With Illustrations.*

Malaria. *Climate* 3 (1901): 12–19. **Macgregor.**
Malaria and its Prevention. By His Excellency Sir William MacGregor, K.C.M.G. *With Illustrations.*

Museum Reports, etc. ———
Report of the Board of Education, 1900–1901. Vol. iii.—Appendix to Report. Reports and Returns (Museums, etc.), Instructions and Minutes. London: Eyre & Spottiswoode, 1901. Size 9½ × 6, pp. vi. and 618. *Price* 2*s.* 6*d.*

Includes, among other reports, that of the Director-General of the Geological Survey for 1900.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**

Ordnance Survey of England and Wales:—Revised sheets published by the Director-General of the Ordnance Survey, Southampton, from November 1 to 30, 1901.

1-inch:—

Printed in colours: 16 and 17 (combined), 169, 171, 173, 174, 195, 196, 1*s. each.*
Towns and surrounding country, with roads printed in colour. Banbury, 1*s.* 3*d.*

6-inch—County Maps:—

Bedfordshire, 7 N.E., 34 S.E. **Derbyshire**, 57 N.E. **Merionethshire**, 5 S.E., 14 S.W. 15 N.W., N.E., 16 S.E., 19 S.W., 26 N.E., S.W., 28 S.W., 29 N.W., N.E. (31 S.E. and 32 S.W.), 32 N.W., 33 S.E., 34 N.E., 35 N.E., 36 N.W., S.E., 37 N.W., S.W., S.E., 38 N.E., S.W., 39 N.W., N.E., 41 S.E., 42 N.W., N.E., 45 S.E. **Monmouthshire**, 18 S.E. **Montgomeryshire**, 3 N.E., 7 N.E., 12 N.E., 18 N.E. **Northamptonshire**, 40 S.E., 41 N.W., 47 N.E. **Staffordshire**, 29 N.E., 31 N.W., 32 S.W., 38 S.E., 39 S.W., S.E., 40 S.W. **Wiltshire**, 49 N.W., 51 S.W., 56 S.E., 57 N.W., S.W., 63 N.E., 64 N.W., 65 S.W., S.E., 66 N.W., 67 N.E., 69 N.W., 71 N.W., S.E., 72 N.W., 73 N.W. 1*s. each.*

25-inch—County Maps:—

Cambridgeshire, V. 10, 11, 12, 14, 15, 16; VI. 9, 13; X. 2, 11, 12, 13; XI. 2, 5, 6, 7, 10, 11, 13, 14, 15; XIV. 2, 4, 8; XV. 1, 2, 3, 5, 6, 9, 10, 13, 14; XX. 1, 2, 5, 7, 10, 11, 14, 15; XXIV. 3, 4, 7, 8; XXXVIII. 13; XLIV. 12; XLV. 1, 2, 7. **Dorsetshire**, III. 8; VIII. 5, 13; XIV. 1; XXIV. 1, 5, 7, 9, 13; XXXIII. 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 14, 15, 16; XXXIV. 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16; XXXV. 8, 10, 11, 12; XLIII. 1, 2, 3, 5, 6, 7, 10, 11, 12, 13, 14, 15; L. 1, 2, 3, 4, 6, 7, 8, 9, 11, 12, 13, 14; LI. 1, 6, 10. **Gloucestershire**, I. 11, 15; II. 9, 10, 11. **Huntingdonshire**, III. 13; V. 4; VII. 9, 13, 14; XI. 1, 2, 5, 9, 10, 13, 14, 15; XV. 1, 2, 3, 4, 5, 7, 8, 9, 13; XIX. 1, 2, 5, 6 9, 10, 13; XXVI. 13; XXVII. 12; XXVIII. 1, 2, 7. **Monmouthshire**, XXX. 1, 14, 16; XXXI. 5; XXXV. 2, 4, 5, 6, 9; XXXVIII. 2, 6. **Montgomeryshire**, X. 16; XI. 11; XXV. 16; XXVI. 12, 13, 14, 15, 16; XXVII. 1, 2, 5, 6, 7, 10, 12, 14, 15; XXVIII. 3, 7, 9, 11; XXXIII. 3, 4, 7, 10; XXXIV. 2, 3, 6, 7. **Shropshire**, XIV. 13, 14, 15, 16; XX. 3, 4, 6, 7; XXI. 4, 9, 10, 13; XXVI. 11; XXVIII. 9, 11. **Staffordshire**, XXXVII. 11; XLIV. 4, 8; XLVII. 5, 6, 9, 13; LIII. 6, 7, 11, 16. 3*s. each.*

4 miles to 1 inch:—

County maps, with roads printed in colour. Isle of Man, 9*d.*

Miscellaneous Maps.

6-inch scale. Bermuda, special map of, in six sheets. 2*s. each.*

(*E. Stanford, London Agent.*)

France. **Thoulet.**

Carte Lithologique sous marine des Côtes de France. Par M. Thoulet. Paris: A Challamel. 10 sheets. *Presented by the Author.*

Sheets 8 to 17 of Prof. Thoulet's lithologic charts of the coasts of France, which have just been presented to the Society, show the whole of the western coast from the Channel Islands to the neighbourhood of Arcachon, with the character of the submarine rocks, for distances varying from 30 to 50 miles from the shore. As in the case of those previously published, Prof. Thoulet has based his charts, so far as outline and soundings are concerned, upon those of the "Service Hydrographique de la Marine." A vast amount of information with reference to the rocks and rock formations is given by means of different colours and symbols. Contour lines at intervals of 10, 50, and 100 metres are shown, and numerous soundings are given in figures.

Germany. **Krauss.**

Radfahrer-Uebersichtskarte von Deutschland und den benachbarten Ländern, herausgegeben vom Deutschen Radfahrer-Bunde. Bearbeitet von P. Krauss. Scale 1 : 850,000 or 11·8 stat. miles to an inch. Sheets 1, 3, 5. Bibliographisches Institut, Leipzig.

The first three sheets of a six-sheet road map of Germany and portions of the surrounding countries, specially useful to cyclists and tourists.

Liverpool. **Bartholomew.**

Plan of Liverpool. Scale: 300 yards to an inch. By J. Bartholomew, F.R.G.S. London: W. H. Smith & Sons. New edition. *Price 2s. Presented by Messrs. J. Bartholomew & Co.*

ASIA.

Afghanistan, Persia, India, etc. **Langhans.**

Politisch-militärische Karte von Afghanistan, Persia, und Vorder-Indien, zur Veranschaulichung des Vordringens der Russen und Engländer. Scale 1 : 7,500,000 or 118 stat. miles to an inch.—Afghanistan und Russisch-Englische Grenzgebiete. Scale 1 : 4,000,000 or 63 stat. miles to an inch. With insets. Von Paul Langhans. Gotha: Justus Perthes, 1901. *Price 1 mark.*

This map has been specially prepared to illustrate the advance of England and Russia in Central Asia. It shows all railways and telegraph lines, principal trade routes, including the new British Quetta-Kerman route from India to Persia. Much information by various symbols concerning the location and strength of British and Russian military forces on the Indian and Russian frontier is also given, and the map for general reference will doubtless be useful. The famine-stricken districts of India in 1865 and 1900 are indicated by tinting. An inset is given on an enlarged scale of the Punjab, northern Baluchistan, Afghanistan, and the adjoining regions of Russian Central Asia, but there is upon it no indication of the new Indian North-West Frontier Province. There are two other insets; one of Asia on a small scale, showing the increase of British and Russian power, with the dates in red, when certain territories were acquired by the respective countries; and another of south-west Germany, on the same scale as the principal map, for comparison of areas. Statistical information of a military nature is given on the cover. The map is based upon sheets of Stieler's Hand-Atlas.

Annam. **Service Géographique de l'Indo-Chine.**

Carte de l'Annam. Scale 1 : 100,000 or 1·6 stat. miles to an inch. Sheets: "Ha-Dong," "Tourane," "Hué," "Poulo-Canton," "Quang-Ngai," "Phu-Gia," "Phu-My," "Bong-Son," "Phu-Yen," "Qui-Nhon." Service Géographique de l'Indo-Chine, 1900. *Price of each sheet,* $0.60.

These sheets form part of a large-scale map of Annam, now in course of publication. It is printed in colours; the hills are shown by a system of brown horizontal lines having the appearance of true contours, but there is a note in the corner of each sheet, explaining that they must not be mistaken for such. Roads are in red, and water blue.

Asia Minor. **Diest.**

Karte des nordwestlichen Kleinasien in vier Blättern, nach eigenen Aufnahmen und unveröffentlichtem Material auf Heinrich Kiepert's Grundlage neu bearbeitet von Walther v. Diest. Scale 1 : 500,000 or 7·8 stat. miles to an inch. Sheet C, Salichli. Berlin: Alfred Schall.

When completed, this map will consist altogether of four sheets. It has been compiled by Major W. v. Diest, from recent surveys and unpublished materials, based upon Dr. H. Kiepert's well-known map of Western Asia Minor upon the same scale. An account was given of the author's own surveys, accompanied by maps, in *Petermanns Geographische Mitteilungen* for 1898. Hill work is shown by brown shading, and the low-lying districts are tinted green. Ancient names of towns are given in many instances, in addition to the modern names. Heights are given in metres.

Asiatic Russia. **Ministry of Ways and Communications.**

Map of Asiatic Russia. Scale 1 : 4,200,000 or 66·3 stat. miles to an inch. St. Petersburg: Ministry of Ways and Communications, 1901. Russian character. 8 sheets.

This map is specially interesting, inasmuch as it shows the condition of Russian railways in Central Asia up to a few months ago, when it was published. Both the Trans-Siberian and Trans-Caspian systems, with their proposed branches and connections, are clearly laid down. It includes the region from the Caspian to the Pacific coast, and the northern frontier of India to Tobolsk. In addition to railways, both constructed and proposed, the map shows roads, telegraphs, and other useful information.

Indo-China. **Bureau Topographique des Troupes de l'Indo-Chine.**

Carte de l'Indo-Chine. Scale 1 : 500,000 or 7·8 stat. miles to an inch. Sheets: "Vien Tiane," "Qui Nhon," "Nha Trang," "Quang-Tcheou," "Lieng Shui," "Laokay," "Korat," "Khong," "Bang Kok," "Pak Nam," "Vinh Long," "Saigon," "Ou Tcheou," "Tourane," "Hué," "Vinh." Bureau Topographique des Troupes de l'Indo-Chine. *Price of each sheet*, $0·60.

These sheets form part of a map of Indo-China, which is to embrace the whole region from Tongking to Cochin China, and to include portions of the adjacent territories. It is evidently reduced from the larger-scale map (1 : 200,000), but the style of work is decidedly rough.

Manchuria. **Borodovsky.**

Map of Manchuria. Scale 1 : 3,300,000 or 45·2 stat. miles to an inch. By S. O. Borodovsky. St. Petersburg: V. Kershbauma, 1901. With an index. Russian character. *Presented by the Author.*

An earlier edition of this map was noticed in the *Geographical Journal* for December, 1897. It has been revised, and is now accompanied by a pamphlet giving an explanatory note on the map, a list of books and maps on Manchuria published since 1896, which have been consulted and utilized in the revision, and finally a good index of place-names.

The map is printed in colours, and shows political boundaries, railways proposed and constructed, telegraphs, roads, location of minerals, relative importance of towns, and other details of a similar nature, whilst altitudes are given in feet. An inset of the neighbourhood of Port Arthur is given on an enlarged scale, as well as plans of five of the principal towns.

Yunnan. **Bureau Topographique des Troupes de l'Indo-Chine.**

Yun-Nan, Frontières nord-ouest de l'Indo-Chine. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Bureau Topographique des Troupes de l'Indo-Chine. 2 sheets. *Price* $0·60.

This map of Yunnan includes also considerable portions of the adjacent territories, extending from Mandalay on the west to Hanoi on the east, and from the latter place on the south to Suifu, in Sechuan, on the north. It is a rough production, printed in colours, and the feeble attempt to represent the relief by shading is certainly not satisfactory. A fair amount of detailed information is given along the routes traversed, but the map might have been more complete if care had been taken to make use of all the available material furnished by travellers. For instance, so long ago as 1898 there was a report published, with a map, of an important journey by Mr. F. S. A. Bourne, containing fresh information and many altitudes, which the compiler seems to have overlooked, or failed to utilize as he could have done.

AFRICA.

Tunis. **Service Géographique de l'Armée, Paris.**

Tunisie. Scale 1 : 100,000 or 1·6 stat. miles to an inch. Sheet lvii., Sfax. Service Géographique de l'Armée, Paris. *Price* 1.20 *f.*

West Africa. **The Chartographic Company, London.**

Map of the West African Gold Mines. Scale 1 : 157,408 or 2·8 stat. miles to an inch. London: The Chartographic Company, 1901. 4 sheets. *Price* £2 2*s.* *Presented by the Chartographic Co.*

Another of the many maps of the Gold Coast and adjacent territories, produced for the special purpose of showing mining claims and limits of concessions, which in the present case are shown in red. Roads are given in brown, and water blue. It is an outline map only, ruled in squares of one minute of latitude and longitude each, evidently to facilitate the addition of fresh information, or the limits of other concessions.

AMERICA.

Argentine Republic. **Buenos Aires and Pacific Railway Co.**

Map of the Argentine Railways. Scale 1 : 2,534,400 or 40 stat. miles to an inch. Buenos Aires and Pacific Railway Co., Buenos Aires and London, 1901. *Presented by the Publishers.*

A new edition, showing railways constructed and proposed.

Brazil. **Jannasch.**

Karte von Südbrasilien. Rio Grande do Sul, Santa Catharina, Paraná, nebst den

Grenzländern. Scale 1 : 2,000,000 or 31·6 stat. miles to an inch. Von Dr. R. Jannasch. Berlin : Leopold Kraatz, 1902.

GENERAL.

German Colonies. **Sprigade and Moisel**

Grosser Deutscher Kolonialatlas. Bearbeitet von Paul Sprigade und Max Moisel. Herausgegeben von der Kolonial-Abtheilung des Auswärtigen Amts. Lieferung 1, Kamerun in 6 blättern. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Berlin : Dietrich Reimer (Ernst Vohsen), 1901. *Presented by the Publisher.*

In consequence of many recent explorations and surveys, the German Colonial Office has decided to publish a new atlas of the German colonies, with maps on a larger scale than most of those that have hitherto existed. The first part, above mentioned, has just been received. The maps will be prepared under the supervision of Messrs. Sprigade and Max Moisel at the well-known cartographical institute of Dietrich Reimer (Ernst Vohsen), Berlin, and will, with few exceptions, be all drawn upon the scale of 1 : 1,000,000. They are to be printed in colours, and great care will be taken to make use of the best available material. Judging from this first part, which includes the Kamerun region, in six sheets, the atlas promises to be a most excellent and valuable production. It will consist altogether of thirty sheets of maps, and will be accompanied by letterpress.

World. **Johnston.**

The Victoria Regina Atlas. Physical, Political, and Astronomical, containing 200 plates and complete index. 2nd edition. W. & A. K. Johnston, Edinburgh & London, 1901. *Presented by the Publishers. Price from £1 1s. to £2 5s. according to binding.*

This is the second edition of an atlas which first appeared about four years ago. No new maps have been added, and, although an attempt has been made to bring it up to date in some instances, there is still much that needs attention. For instance, the rainfall map of the world, No. 23, remains just as it appeared in the first edition, notwithstanding the fact that much important information has been obtained since then, and Dr. A. J. Herbertson's valuable work, with maps, has been published by this Society, which, however, the publishers seem to have ignored. The topographical features on some of the maps are very much out of date, as in the case of Abyssinia, where it is clear that little or no use has been made of the work of recent explorers in the southern part of the country. On map No. 112, the Sudan railway is only shown as far as Shendi, instead of to Khartum. Then, again, some of the maps of South America are very much behindhand. Important maps that have appeared from time to time in the *Geographical Journal*, and which might have been made use of, have apparently been overlooked, whilst the railways in South America are also in several cases out of date. The northern boundary of Paraguay, as shown on map No. 189, is entirely different from that given on map No. 197.

However, there are some improvements upon the earlier edition, and in several cases it is apparent that the maps have been more or less revised. The idea of utilizing the general maps of England, Scotland, and Ireland as indices for the more detailed maps of the counties, by ruling and numbering upon them the sheets of the larger-scale maps, is certainly a good one. The style in which the maps have been produced cannot be considered satisfactory; the hill-work and other physical features are often very confused and indistinct, and the lettering in many cases is so small as to be almost illegible, owing, apparently, to the process of reduction from maps of larger scales.

World. **Stieler.**

Neue, neunte Lieferungs-Ausgabe von Stielers Hand-Atlas, 100 Karten in Kupferstich. 1 Lieferung. Gotha : Justus Perthes, 1901. *Price of complete atlas, in 50 parts, will be 30 marks, or 60 pg. per part. Presented by the Publisher.*

The last edition of Stieler's Hand-Atlas was completed just ten years ago, and since that time exploration and geography generally has made much progress. Regions that then had to be represented by blank spaces have now been explored, and districts that were at that time but comparatively little known have been carefully mapped, in addition to which many alterations have taken place in boundary-lines, especially of the territorial possessions of European countries. All this has rendered it most desirable that a new edition of this well-known and excellent atlas should appear, which it is gratifying to know the publishers have taken in hand, and of which they have now issued the first part. According to the prospectus, this new edition, the ninth that has been published, will contain altogether one hundred maps, being five more than were given in the last edition. Of these, forty-nine are quite new or have been entirely redrawn, while pains have been taken to bring the others up to date.

Several of the maps in the previous edition have been cancelled, and many are to be superseded by new ones, generally drawn on enlarged scales. Among the more important of the new maps is one of Siberia, in 2 sheets, on the scale of 1 : 7,500,000; China, 1 : 7,500,000; Africa, on 6 sheets, 1 : 7,500,000, which is to supersede the previous map on the scale of 1 : 10,000,000; Australia, in 4 sheets, 1 : 5,000,000; a map of Eastern Canada, 1 : 7,500,000, to supplement the map of West Canada and British Columbia, previously given on the same scale. These maps will add considerably to the value of the atlas, and some of them were very much needed. The whole atlas is to appear in fifty parts, each containing two maps, in addition to which there will be a full alphabetical index to place-names. It is the intention of the publishers to issue one part every two or three weeks.

Instead of the hill-work being in black hachuring as hitherto, it is now shown in brown, which ought to be an improvement, inasmuch as the names, printed in black, should be more legible; but in the map of China, which appears in this part, the result cannot be considered altogether satisfactory. This is one of the new maps, and certainly gives a vast amount of information for a map on so small a scale; it is, however, somewhat overcrowded, and from one reason and another decidedly lacking in clearness, especially in the western portion.

On the back of each map is a small index, squared in to show the area included in the map itself, as well as those embracing the adjacent regions, with their numbers.

The most important alteration of all is in the price, for the complete atlas is to cost only 30 marks, which is less than half the price of the previous edition.

It is, however, to be hoped that this reduction in price does not mean a lowering of the standard of excellence in the execution of the maps, which has hitherto characterized this well-known atlas.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, September and October, 1901. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
3227 to 3238		Monthly wind charts for coasts of South America. 6*d.*
3192	m = 6·0	Scotland, west coast:—Loch Broom (upper portion). 2*s.* 6*d.*
3104	m = 1·4	England, east coast:—Hartlepool to Blyth. 2*s.* 6*d.*
3212	m = 7·0	Ports on the east coast of Italy:—Port of Ancona. 1*s.* 6*d.*
3197	m = $\begin{Bmatrix}1·8\\3·6\end{Bmatrix}$	Cuba:—Mevitas bay. Entrance channel. 2*s.* 6*d.*
3213	m = 3·0	Plans on the north coast of Brazil:—Port Timonha, Port Camocim. 1*s.* 6*d.*
1921	m = $\begin{Bmatrix}6·0\\1·0\end{Bmatrix}$	Plans in the Indian ocean:—St. Paul island, Amsterdam island. 2*s.*
3214	m = 1·0	Red sea. Suez bay:—Ports Ibrahim and Thewfik. 1*s.* 6*d.*
1143	m = $\begin{Bmatrix}7·4\\5·6\end{Bmatrix}$	Anchorages in Malacca strait:—Wanderer bay, Arang Arang anchorage (republication). 1*s.*
3209	var.	Bays and anchorages in Makassar strait. 1*s.* 6*d.*
1578	m = 4·0	Japan:—Simonoseki strait. 2*s.* 6*d.*
3196	var.	Harbours and anchorages on the west coast of Nipon, Japan. 1*s.* 6*d.*
3200	m = 0·35	Japan:—Aikappu Misaki to Rebun islands. (Plans:—Kabuka Biochi, Oniwaki Biochi, Teshio Gawa-Gashi.) 2*s.* 6*d.*
3198	m = 0·9	Russian Tartary:—Askold island to Cape Povorotni. 2*s.* 6*d.*
3222	m = 3·0	Russian Tartary:—Rikorda island to Larionoff point. 2*s.* 6*d.*
1002	m = 0·25	Australia, south coast:—Rivoli bay to Cape Otway. 2*s.* 6*d.*
1014	m = 0·25	Australia, south coast:—Cape Jervis to Rivoli bay. 2*s.* 6*d.*
1383	var.	Islands and anchorages in the south-east Pacific ocean:—Juan Fernandez, Cumberland bay, Mas a Fuera island, St. Felix and St. Ambrose islands, St. Felix road (republication). 1*s.* 6*d.*
2194		Anchorages in the northern part of Celebes. New plans:—Bolang Uki bay, Sumalata road, Himana bay, Pienchang bay, Domisil bay, Paleli and Lintidu roads.
208		Japan:—Harbours and anchorages on east coast Nipon. New plan:—Uchiura Wan.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.		Cancelled by	No.
200	Plan of Ancona on this chart.	New plan. Port of Ancona	3212
411	Plans of Puerto de las Nuevitas del Principe on this chart.	New plan. Neuvitas bay	3197
1921	St. Paul island.	New sheet. Plans in the Indian ocean	1921
1945	Amsterdam island.		
1143	Anchorages in Malacca strait.	New sheet. Anchorages in Malacca strait	1143
2194	Plan of Kaidipan and Bolang Itam anchorages on this sheet.		
2662	Plans of Wani bay, Membora road, Palos road, Dangola road, and Mamuju bay on this sheet.	New sheet with these plans	3209
3003	Plans of Tobi shima anchorage and Kamo harbour on this sheet.	New sheet with these plans	3196
2432	Plan of Nayezduik bay on this sheet.	New chart	3198
1117	Plan of Abrek bay on this sheet.		
1062	Glenelg river to Cape Otway.	New chart. Rivoli bay to cape Otway	1062
1014	Cape Jervis to Guichen bay.	New chart. Cape Jervis to Rivoli bay	1014
1015	Guichen bay to Glenelg river.		
1383	Jan Fernandez. Mas a Fuera island.	Islands and anchorages in the south-east Pacific ocean	1383
1344	Cumberland bay.		
1276	St. Felix and St. Ambrose islands, plans on this sheet.		
2432	Plan of anchorages on the west coast of Kazakavitch island, on this chart.	New chart	3222

Charts that have received Important Corrections.

No. 1185, England, east coast:—River Thames, sea reach. 60, Channel islands:—Alderney and the Casquets. 117, Fœroe islands. 2296, Gulf of Bothnia:—South Quarken to Hornslandet. 2302, Gulf of Bothnia:—Tome point to Tauvö. 33, Germany:—Kiel Fiord. 2206, Black sea:—Odessa bay. 2220, Ports on the south shore of the Black sea. 2216, Turkish ports on the south shore of the Black sea. 282, Newfoundland:—St. John bay to Orange bay. 1144, Magdalen islands:—Grand Entry harbour. 2029, Prince Edward island:—Cardigan bay. 519, Lake Huron. 334, Lake Huron:—Strait of Mackinac. 2522, South America, east coast:—Santa Catharina island to Rio de la Plata. 2887, United States, west coast:—San Pablo and Suisun bays. 592, British Columbia:—Barkley sound. 2462, Alaska:—Windham bay to Icy cape. 713, Mauritius:—Port Louis. 833, Bay of Bengal:—Rangoon river and approaches. 1009, Malacca strait:—Approaches to Perak river. 2201, Plans in Sumatra. 1153, Celebes:—Pulo Mutivo to Tanjong Sutuno. 931, Philippine islands:—Ports Subie and Silanguin. 2734, China, south coast:—Si Kiang or West river, Sheet 2. 1570, Korea:—Approaches to Chemulpho. 104, Korean archipelago, southern portion. 2877, Japan:—Uwajuna bay. 1055, Australia, west coast:—Bedont island to Cape Cuvier. 2747 A and B, Australia, south coast:—Entrance to Port Philip, 2 sheets. 105, Tasmania:—Port Hobart. 2922, Australia, east coast:—Turtle group

to Claremont point. 2532, New Zealand:—Ninety Miles head to Otago. 1417, South Pacific:—Chatham islands.
(*J. D. Potter, Agent.*)

North Atlantic Ocean and Mediterranean Sea. **Meteorological Office, London.**

Monthly Pilot Chart of the North Atlantic Ocean and Mediterranean Sea for December, 1901. Meteorological Office, London. Price 6*d*. *Presented by the Meteorological Office.*

United States Charts. **United States Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for December, 1901. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Baffinland. **Bell.**

Fifteen Photographs of Baffinland by Dr. R. Bell, F.R.S., 1897. *Presented by Dr. R. Bell.*

These photographs are of different sizes and vary considerably in merit; some of them are, however, very good. They were taken during a journey of exploration in Baffinland by Dr. Robert Bell in 1897, an account of which was given in the *Geographical Journal* for July last. The titles are as follows:—

(1) Esquimaux kyaking near Amadjuak fiord; (2) Typical view on south coast of Baffinland; (3) Looking up Cañon inlet; (4) Head of northern inlet of North Bay; (5) Typical view across country in southern Baffinland; (6) Bouldery valley; (7) View across Tussi-mi-la-roong lake; (8) Kyakers passing Amadjuak bay; (9) View of Tussi-mi-la-roong lake; (10) Small glacier; (11) Knob at outlet of Cross lake; (12) Typical summer day; (13) Big island from the south; (14) Kyakers approaching; (15) Esquimaux women in Oomiak.

Canada. **Bell.**

Twenty-four Photographs of the Great Bear lake region, by J. Macintosh Bell, Esq., M.A. *Presented by J. Macintosh Bell, Esq.*

The journey of Mr. J. Macintosh Bell last year, during which these photographs were taken, was described in the *Geographical Journal* for September last. The subjects are well selected, and some of the views will be specially interesting to geologists and students of physical geography, as, for example, those showing the old shores of Great Bear lake, glacial erratics, the Tundra country, south of Coronation gulf, and several others. The following is a list of the titles:—

(1) Glacial erratics, Cape MacDonnell; (2) Northern natives; (3) French half-breed native in the Mackenzie river region; (4) Freetraders' establishment, Fort Resolution; (5) Dog-teams on the Mackenzie river; (6) Old shore-lines (terraces), north shore of MacTavish bay; (7) White spruce trees at old Fort Confidence; (8) Chute des Canards, Camsell river; (9) Old shores of Great Bear lake, Cape MacDonnell; (10) Sand barrens and trees excavated out of the sand by the wind, east shore, Russel bay; (11) Itkan lake, Barren Lands, south of Coronation gulf; (12) Greenstone cliffs, east shore of MacTavish bay; (13) Wind-excavated trees, east shore of Russel bay; (14) Christianized Indian children, Fort Providence; (15) Hudson Bay Co.'s post at Fort Simpson; (16) Indian children, Fort Providence; (17) Old Fort Confidence, north-east end of Great Bear lake; (18) White Eagle falls, Camsell river; (19) Tundra country, south of Coronation gulf; (20) Dogrib Indian camp, near Dawaso-necha lake; (21) Dawaso-necha lake; (22) Trees and quartzite talus slopes, near Fort Confidence; (23) Drumlins (glacial mounds), Barren Lands, south of Coronation gulf; (24) Trees covered with sand, by wind, east shore, Russel bay.

Central Africa. **Weatherley.**

Forty-five Photographs of British Central Africa, by Poulett Weatherley, Esq., 1898. *Presented by P. Weatherley, Esq.*

The Society is already indebted to Mr. Poulett Weatherley for many excellent photographs of the Lake Mweru and Bangweulu region of Central Africa, and these form a welcome addition to those he has already presented. Many of them are extremely good.

(1) The Luapula, near its entrance into Bangweulu; (2) The native who ferried Livingstone across the Lulimala, the last day of Livingstone's life; (3) Mumbotuta

from my camp: (4) Yaremba women (showing tattooing on bodies) wearing (5) A celebrated hunter to the south of Lake Mweru: (6) Headquarter Kasoma's boma, Lake Bangweulu: (7) Mumbotuta: (8) Mumbotuta fro 50 feet below my camp: (9) Kalongwa point from my camp, Lake Bang The coiffure of a native of Kirui: (11) Coiffure of a Mwa Usi: (12 and of a woman of Urua, north-west of Lake Mweru; (14) Digging for wate Chitambo from Kalufwe: (15) Luapula river, near the Luombwa; (16) T about 1½ mile to the north of the Johnston falls; (17) The Luapula opp ma's: (18) First crossing-place on the Luombwa: (19) Luanga, West Native of Kisi—a freak of nature: (21) The Luapula, halfway between t falls and Mweru: (22) Coiffures of natives on the upper Luapula: (23) Vi new station at Chienjé, looking towards Kampingi: (24) Part of the Joh (25) Decayed portion of the mupundu tree, with the Livingstone inscription (26, 27, and 28) Parts of Mambilima, Johnston falls, showing conglomerate View from Lota hill looking north up the east shore of Fungé peninsula Lake Bangweulu: (30) *Vigilant*, self, and crew at Ihota point, after the ci tion of Lake Bangweulu: (31) View from Mwana ngipe's boma, on the w Lake Kampolombo: (32) View of coast and lower plateau of Buhongolo ra north: (33) Mupundu tree at its maturity in summer foliage; (34) Part o Uchinda marsh, south-west Lake Bangweulu: (35) Mumbotuta from Mr. V camp: (36) Mr. Weatherley's porters leaving Kalonga's: (37) Mwa Usi (38) Kawandé musi in the extreme distance, and part of the Great marsh: (39) The mupundu tree under which Livingstone's heart was bur forked mutowo tree in the background (not the visitor's tree) the body of was placed to dry in the sun during the process of embalming: (40) inscription on the mupundu tree: (41) The mupundu, from the left bank river: (42) Luwé river, looking up, a little above the mupundu tree: (4 boat: the centre section was broken up by the Wa Usi for making bullet View of Chifunawuli: (45) A Mwina Kisinga and Mwina Katanga.

Kentucky.

Twelve Photographs of Kentucky, by Miss Semple. *Presented by Mis*

Most of these photographs were reproduced in the *Geographical Journ* last, to illustrate Miss Semple's paper on "The Anglo-Saxons of the Kent tains." They are as follows:—

(1) Mountain types; (2) A mountain saw-mill; (3) Hand-loom and spi for flax: (4) Hand-mill for grinding maize; (5) Saltworks in Clay country scape in a marginal country; (7) A bit of level land; (8) A mountain Cabin of the better sort; (10) Corn-mill in an upland "cove;" (11) An farm: (12) Fording a stream.

Rhodesia.

Fifty-one Photographs of Northern Rhodesia, in the neighbourhood of t river, by G. Grey, Esq., 1899. *Presented by G. Grey, Esq.*

The region through which Mr. G. Grey travelled in 1899, when he photographs, lies to the north of the Zambezi, in the neighbourhood of falls, to about 11° 30′ S. lat., and includes the Kafue river and its tribut views are principally representative of the scenery and incidents of trave

(1) On the Zambezi river, near Binga's kraal: (2, 3, and 4) Taking don a river: (5) Travelling companions; (6) Camp scene—the kitchen; (7) Pac the banks of the Zambezi; (8) Corn crop on the Matoka plateau; (9) Boy li (10) Lion-proof kraal; (11) Nogolo river, near its junction with the Zambe road from Buluwayo to Lubu; (13) Mr. M. G. Farquhar: (14) Pack-mul G. Grey: (16) Mule rolling with pack: (17) Boy riding mule: (18) Donk on road between Zambezi and Lubu; (19) Camp at Lubu; (20) Mopani v Lubu: (21) Mr. N. C. Gielgud, native commissioner, Lubu; (22) Mr Gielg (23) Mr. Gielgud and his boat; (24) German-sausage tree; (25–51) No title

N.B.—It would greatly add to the value of the collection graphs which has been established in the Map Room, if all th of the Society who have taken photographs during their trav forward copies of them to the Map Curator, by whom the acknowledged. Should the donor have purchased the photo will be useful for reference if the name of the photographe address are given.

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The

Geographical Journal.

No. 2. FEBRUARY, 1902. Vol. XIX.

A FOURTH JOURNEY IN PERSIA, 1897-1901.*

By Major P. MOLESWORTH SYKES.

On the previous occasion on which I had the honour of reading a paper before this Society, I gave a general description of the physical features of Persia; I now propose to give some account of the Persian gulf, up and down which I have steamed many times, and I have also had the opportunity of visiting some of the ports which are not touched at by the mail steamers.

The Persian gulf, known in common with the Indian ocean and the Red sea as Erythrean by the ancients, is one of the most interesting bodies of water in the world from the historic point of view, and perhaps in the near future the eyes of Europe may be directed to it as commanding the shortest route to the East. Although constituting a waterway between the ancient civilizations of the world, yet few coasts are more forbidding, and even nowadays sailors always complain that there is either too much or too little wind in "the Gulf," as it is termed. Serrated ranges running parallel to the coast, an absence of sheltered harbours, sunken reefs and dangerous currents, added to the storms so prevalent, must have constituted terrible dangers to mariners attempting voyages, and the inhospitable shores have ever been the abode of a low class of Ichthyophagi, who would have had no mercy on a shipwrecked crew. On the other hand, the climate is never cold, while the extreme heat which is so trying to Europeans is agreeable to the native of its shores; and heat was undoubtedly favourable to civilization at its inception, as the inhabitants of harsh climates were almost compelled to be hunters to keep themselves clothed, and consequently remained longer in a savage state.

* Read at the Royal Geographical Society, November 25, 1901. Map, p. 248.

Chaldæa, according to the tradition preserved by Berosus, was civilized by a creature half man and half fish, who came from the Erythrean sea and taught men the arts of life. Its name was Oannes, no doubt derived from the name of the Chaldæan god of the primæval waters, Ea. This legend undoubtedly points to some higher race arriving by sea, but further than this the mists have not been rolled away. There is, perhaps, no recorded expedition by sea so ancient as that of Sargon I. of Chaldæa, who, about B.C. 3800, navigated the Mediterranean, while his son Naramsin * led an army against Magan,† which may be identified with the mainland opposite the Bahrein islands. It is here, indeed, that, in my opinion, excavations should be made, which might possibly establish records of still earlier voyages. For instance, we learn that in the third millennium B.C., timber and diorite were procured for a priest-king of Lagash (Shirpurla), in Shumer, from Magan and Melukhkha, Nituk ‡ and Gubi, and this points to an established trade.

The oldest legends of the Phœnicians place the cradle of the race in the marshes on either side of the Tigris and Euphrates, or in the Bahrein islands, the largest of which, Tylos and Arados, bore names that were still more famous on the Mediterranean as Tyre and Arvad. It was, indeed, only on account of violent earthquakes that this interesting race migrated across Syria to the Mediterranean sea—at least, that was their own belief.

But the known history of navigation in the Persian gulf hardly begins before the end of the eighth century B.C., when Sennacherib crushed the refugees who had fled to the islands in the gulf by means of ships built by Phœnicians and Cypriote Greeks, whom he brought across from the Mediterranean sea. On the Taylor cylinder the campaign is described as follows: "The remnant of the men of Bit-Yakin . . . took all the gods of the country and crossed the Great Sea of the Sunrising, and took up their abode in Elam. On ships of Hatti-land I traversed the sea. . . ." §

The story of Sennacherib then informs us that navigation was known in the Persian gulf at least as early as the eighth century B.C., and it is unlikely that it was ever entirely suspended, as the land routes lay across the deserts of Central Asia, ever the haunt of predatory tribes, which routes are not, even in the twentieth century, opened up to commerce.

We next come to the period when Babylon was at her zenith, and trade was so flourishing that peacocks and rice were known even in distant Athens at the time of Sophocles and Aristophanes, and that by

* *Vide* 'The Dawn of Civilization,' by Prof. Maspero, p. 600.

† Ibid., p. 564, n. 3.

‡ *R.A.S. Journal*, April, 1898, "The Early Commerce of Babylon with India," by J. Kennedy. Nituk is considered to be Bahrein.

§ 'Light from the East,' p. 197.

their Tamil names.* Under Persian rule Babylon declined, and with her fall direct intercourse with India may have gradually ceased, so that when Nearchos appeared on the scene in 326 B.C., he practically re-discovered what was already a very ancient trade route. I cannot dwell on his famous voyage from the mouth of the Indus to the Kárun, although I shall incidentally refer to it, and as Persia throughout the period of her history never was a sea-faring nation, we come to the times when, in the fifth century after Christ, Chinese ships were seen in the Euphrates.† This adventurous commerce is first mentioned by Masudi in the following passage: "The principal branch of the Euphrates ran past Hira. . . . To this port arrived ships from China and from India." ‡ Moreover, Chinese annals of the Thang dynasty of the seventh and eighth centuries describe in detail the course followed by the junks.

This extraordinary activity was eclipsed by the teeming prosperity of the Arabs in the ninth century, when the trade from the East, enriching Balsora § and Baghdád, gilded Asia with those imperishable legends which are embodied in the 'Thousand and one Nights,' and are responsible for Milton's "gorgeous East." ‖ It was from Balsora that Sinbad set forth on his adventurous voyages which quaintly portray the ideas of the period when the world was but little known, and even to-day the lovely palm-groves and romantic creeks which render Basra an Eastern Venice, retain a glamour of departed glory; while the high-pooped *baggala* in which Sinbad and his companions launched forth upon the deep, can still be counted by scores in the Shat-el-Arab.

When misgovernment began to close the Basra route, the great caravan road *viá* Tabriz to Bandar Abbás took its place. Hormuz, at first situated on the Mináb river, and, when the mainland became unsafe, on the island of Jerun, rose to be the emporium of the East, until perhaps one of the greatest events in history occurred—the arrival of European ships in Eastern waters. Although it is impossible to doubt the ultimate benefit that has been derived from the opening of this great trade-route, which perhaps saved Europe from Asiatic domination by a final severance of the two arteries of the world's commerce *viâ* the Persian gulf and the Red sea, yet it is hard not to feel hurt that our representatives first appeared as pirates far surpassing in their methods the general cruelty of the times. The behaviour of Albuquerque in the Persian gulf was atrocious, and it is difficult to read how he mutilated his prisoners "for the glory of God" without a deep sense of humiliation. For more

* *R.A.S. Journal*, "The Early Commerce of Babylon with India," by J. Kennedy, April, 1898.

† *Vide* 'Cathay and the Way Thither,' vol. i. p. lxxvii. In the ninth century they only came up the Persian gulf as far as Siráf, the modern Tahiri, and later on Hormuz was their furthest point west.

‡ 'Les Praires d'Or,' vol. i. p. 216.

§ Balsora is the modern Basra.

‖ Cf. 'Paradise Lost,' book ii.

than a hundred years the Portuguese, by holding Hormuz, kept their hands on the throat of Eastern trade, while cruising occasionally up the Red sea, until, at the beginning of the seventeenth century, the English appear on the scene.

The recently published diary of Sir Thomas Roe,* our first ambassador to India, is, I would venture to suggest, of immense historical value as showing our actual position in those days. A most salient feature appears to be the smallness of the trade, the whole of India not being able to furnish more than four or five cargoes a year. It was on this account that a ship, the *James*, was sent to Jásk with a view to opening up trade with Persia; † but even so there were difficulties, not only on account of the Portuguese, but also because Shah Abbas wanted little else than cash ‡—although he never refused presents —and in those days, to take bullion out of England was considered to be almost criminal.

In 1620 there were two sea-fights off Jásk, the first being indecisive; but in the second the Portuguese were defeated, and the English factory, which appears to have been founded in 1619, was saved from destruction. Two years later, in 1622, in alliance with Persia's great Shah, Hormuz was taken, and the Portuguese power received a blow from which it never recovered. From this date until to-day British trade and influence, although fluctuating, has been on the increase, and our responsibilities have been faced with a determination which has been unsurpassed in any quarter of the globe.

At the beginning of the nineteenth century, the Jowasmi pirates were strong enough to take H.M.S. *Minerva* after two days' fighting, and every sailor was put to the sword. This affront was only wiped out by some desperate engagements, which forced the truculent Arabs to abstain from sea-fighting and piracy. Since the middle of the century the *pax Britannica* has been maintained, although not without a heavy outlay. In the Bahrein group alone has this peace been broken in recent times, when Sheikh Jásim, in 1895, attempted to invade these islands from Zobára on the opposite coast. However, the punishment meted out to him was short and sharp, forty-four of

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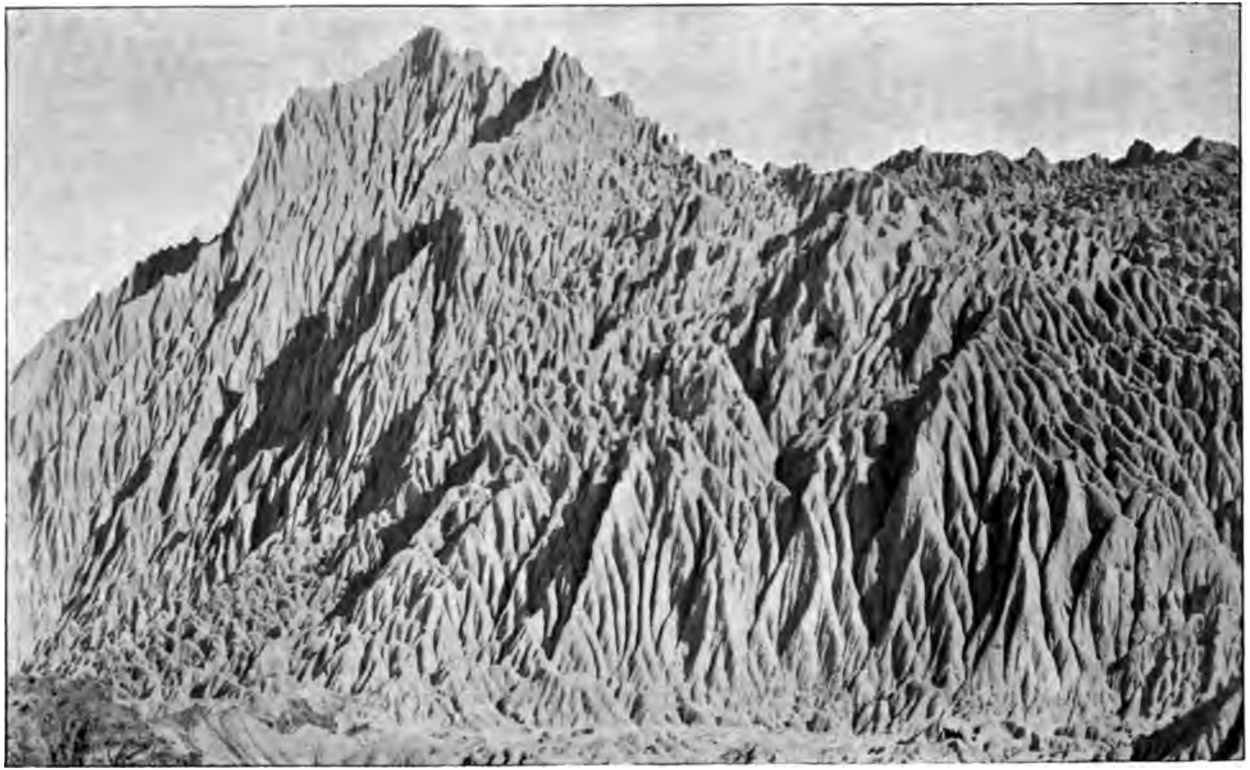
* Edited by W. Foster, under the auspices of the Hakluyt Society.

† Cf. 'Sir Thomas Roe,' p. 330: "That the war with the Turks having blocked commercial intercourse with Europe, there must be in Persia at once a dearth of cloth and a plethora of silk; that it was absolutely necessary to find some vent for the large stock of English goods in their warehouse, for which no immediate sale could be hoped in India."

‡ Cf. 'Sir Thomas Roe,' p. 353: "And obserue one thing well: The parts of Persia that vent cloth, which in Steele's judgement will not exceed 500 a yeare—a small matter—and the rest wilbe expected to be supplyed in mony, are the same that produce the silke and are nearest Turky, as Gordgestan and Gilan; and to those parts cloth can be brought cheaper by Aleppo then by Jasques."



CLAY FORMATION, MAKRÁN.

[To face p. 125.

his ships being destroyed by H.M.S. *Sphinx* and *Pigeon*, while an even larger number was towed off to Bahrein.

At the present time the Persian gulf is crowded with British shipping, Hindustani is the prevalent language at most of the ports, and peace prevails everywhere. It must, however, be remembered that were the British gunboats to quit this land-locked sea, piracy would immediately be re-established; and, as an Arab naïvely remarked to me, the loot would now be ten times as valuable as it was a generation ago.

I reached Bombay in November, 1897, and the beginning of December found me at Bushire. A few days after my arrival, news reached Colonel Meade, the Resident, of the murder of Mr. Graves, of the Indo-European Telegraph Department, while engaged on inspection duty midway between Jásk and Chahbár. Being ordered to proceed there without delay, I was soon steaming down the Gulf on board H.M.S. *Pigeon*, under Commander Mowbray. After calling in at Jásk, we steamed east along the coast, and early in the morning found ourselves off Galag, where the *Patrick Stewart*, with Mr. ffinch, the Director-in-chief of Persian Telegraphs and his staff, and the Persian man-of-war *Persepolis*, were lying at anchor. After consulting with Mr. ffinch, who had already sent off in every direction to collect camels, we landed, a party of thirty all told, and camped near a wretched date-grove. Some eight camels were all that could be procured at first, so that our kit was restricted to about half the usual scale; and an early hour the next morning found us ready to march inland. The sea-shore was quite bare, and inhabited by myriads of small crabs; but once we struck inland the lofty tamarisks gave quite a park-like appearance to the flat level country. After a hot march we reached the banks of the Rapsh, and close to what is technically known as a mast—a miniature Eiffel tower, used when great spans are necessary in telegraph construction—we saw the grave of our murdered countryman. We camped near the Persian force commanded by the Daria Begi, who had sixty men and a gun with him, and then went to hear what my colleague, who had arrived two days previously, thought about the situation.

I found that matters were at a deadlock, as the Karwánis * declined to surrender the murderers, and, the time given them by the Persian admiral expiring on the following evening, we decided that, unless hostages were given, we should march to the Karwán villages, which were said to lie some 10 miles to the north, under the low range of hills that apparently runs the whole length of Makrán.† Tents, supplies,

* Is it not at least possible that we here find the Caraonas of Marco Polo? The tribe is famous for lawlessness, and is distinct from the Baluchis.

† The origin of the word "Makrán" has interested me for many years. Sir T. Holdich accepts the derivation given by Sir Oliver St. John, that Makrán is a contraction from

and camels were all sent up by the indefatigable Director-in-chief, while in the afternoon Mr. Sealy, Director of the Persian gulf section, came into camp, having, with the aid of officers of the *Patrick Stewart*, completed a temporary line. They all joined us, and, in the evening, Mr. Wood of the Imperial Bank of Persia came riding up, thus completing our party.

At 3 a.m. we marched off, but an unwilling guide led us by rather tortuous paths, so that at sunrise we were still far from the hills. At a point where the tracks separated he was so anxious for us to go to the right that we went to the left, and soon saw that our decision was correct, as a large party came out for a palaver. This was merely a feint to gain time, and when we at last reached a large village we found it deserted. At night we had three officers for each watch, and between each pair of sentries two natives were told off to listen, as seeing was almost impossible. About 10 p.m. a shot was fired at a sentry, and we heard a murmur as of a large body of men; but Mowbray fired a Verrys red light, and so stopped a rush, if any was intended. The next day we changed our camp to a better site, and before sunrise on the following day a reconnaissance in force started off west, and we drove the Karwánis from a large date-grove. In the meanwhile the Resident had arrived at Rapsh, so I rode in to report, and three days later he reached the Karwán district. Our force being doubled, we had to change our camp, and after a day or two, as there was nothing more to be done for the present, we returned to the coast, where Commander Carr, C.M.G., a Fellow of this Society, gave me a passage to Maskat.

After coaling we ran across to Hormuz, and at length my desire of visiting that famous island was realized. Producing nothing but salt and oxide of iron, Hormuz is, apart from its fisheries, dependent for its daily bread on the mainland, while there is not a drop of fresh water anywhere. The magnificent fort, which we captured in alliance with Shah Abbás, is still in an almost perfect state of preservation. We entered by a massive door studded with iron spikes and protected in front and flank by bastions. After passing the guardhouse, the lower *enceinte*, covering about an acre, lay before us, from which a sharp rise led to the inner work, where the most conspicuous object was a superb reservoir; a second incline brought us to all that remained of a sumptuous palace, from which we could see into the ruined town,

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máhi and *Khurán*, two modern Persian words which represent the Ichthyophagi of Arrian. However, the word is apparently much more ancient, and I offer the following suggestion. Although Assyriologists differ as to whether Magan represents the Sinaitic peninsula or Oman and the country behind Bahrein, we have, at any rate, the Maka of the inscriptions, and the Mykians or Mekians of Herodotus, who locates them to the west of Makrán. Now, the coast was a waste, or *ran*, as it is still termed in Sind, the word being the Sanscrit *irina*. Is it not, then, possible that in *Maka irina*, signifying the "waste of Maka," we have at last traced the origin of this much-debated word, that was in the early years of the *Hijra* pronounced Mokkarán?

while numerous rusty cannon, not much bigger than popguns, testified to the fact that there were more guns than could be conveniently carried off when the fort was abandoned. Descending, we examined what was apparently a breach made by the sea, and seeing that this stronghold was indeed "so well fortified with deep trenches, counterscarp, and great ordinance commanding both city and haven, that none exceeded it through all the Orient," * we felt proud that our countrymen had made such a glorious entrance on to the stage of Persia, which the heroic resistance of the Portuguese but served to enhance.

The town is entirely destroyed, and all that we noticed were several hundred reservoirs, while on a little hill on the south side of the bay are the ruins of what was undoubtedly a chapel. Musing over the utter desolation, it was difficult to believe that such a spot could ever have been a famous city; yet no traveller passed through it but sounded its praises, Abdur Razzak, as the following extract will show, being not the least enthusiastic: "'Ormuz,' which is also called Jerun, is a port situated in the middle of the sea, and which has not its equal on the surface of the globe. The merchants of seven climates all make their way to this port; they bring hither those rare and precious articles which the sun, the moon, and the rains have combined to bring to perfection." †

From Hormuz we tried to make Kishm, but it was too rough, and we were consequently unable to pay our tribute to the great explorer Baffin, who was in charge of a gun at the siege of the castle, which preceded that of Hormuz, and "received a small shot from the castle into his belly, wherewith he gave three leapes, by report, and died immediately." ‡ Kishm has more recently (in 1896) acquired a melancholy notoriety as the scene of an earthquake, which killed more than a thousand of its inhabitants and did an immense amount of damage.

So long as we were coasting we were in a rough sea, but the moment we reached the land-locked harbour between it and Henjám, we were once again in still water, and easily realized Sir John Malcolm's high opinion of it. Henjám, although now supporting the scantiest of populations, was once densely inhabited, as the extensive ruins prove, while for a few years it was a telegraph station, connecting Bushire with Jásk.

Upon returning to Maskat, after a most enjoyable cruise, I found the Resident just about to start for Chahbár, so I left the hospitable *Lapwing* and transferred myself to the R.I.M. ss. *Lawrence*, where I was among old friends. I accompanied Colonel Meade on his farewell visit to the

* 'Some Yeares Travels into Africa and Asia the Great,' by Sir T. Herbert, p. 106.

† 'Journey of Abdur Razzak,' p. 5. Hakluyt Society.

‡ 'Purchas Pilgrims,' vol. ii. lib. x. cap. 9.

Sultan, where we were received in what struck me as a very European room, until I remembered that it was the Portuguese Government House and factory, the building being three-storied. His Highness, who knows a little Hindustani, appeared to take a great interest in the topics of the day, in which he was evidently versed, and invited me to call whenever I passed through Maskat.

The Resident came on board the *Lawrence*, amid the thunder of a salute, and the following morning we reached Chahbár, where half a company of Bombay Marine Infantry, under Captain Creagh, an old schoolfellow, had just arrived, the telegraph station being threatened by Abdi Khán of Dashtiári. I saw the latter later on at Kermán, the Governor-General, at my request, having seized and imprisoned him. A few hours passed and the *Patrick Stewart* appeared on the scene, turning all into bustle at the usually quiet station.

Being anxious to visit Pasni and Ormára, in the evening I accompanied Mr. ffinch on board the *Patrick Stewart*. The lamp on the steam-launch attracted large numbers of fish with a sharp snout, many of which leaped on board, and one of the party was nearly blinded, the fish striking him just below the eye.

The next morning found us at Gwádur, where we were told that there had been hundreds of tons of fish driven on shore by a storm, which had apparently increased the activity of some gas, supposed to be sulphuretted hydrogen, which has in recent years poisoned the sea. A narrow track had been beaten down, but one of our party neglected to use it, and sank almost up to the waist in a veritable fish-bog. Matters were somewhat unsettled, as the Kej rising had affected the neighbouring Rinds, and not only had the telegraph-line been destroyed in both directions, but a raid on Gwádur was quite possible. We sympathized with the postmaster, who said that he expected to find his throat cut every morning, and cheered him up by telling him that troops were on the way to relieve the situation.

I was delighted to have the chance of visiting Pasni, the next point at which we touched, as, although perhaps the most filthy and squalid village in my experience, it was just about here that Alexander the Great, after turning the Taloi range, to the north of which his army had endured all the horrors of thirst, rode on ahead with a few horsemen and dug the shallow wells which saved his exhausted forces.

The same evening Ormára was reached after sunset, and upon landing I started off with a guide to find the force which was on the point of starting, under Colonel Mayne, on what proved to be so successful an expedition. Questions were asked as to the state of Pasni, and the chances of the Baluchis making a stand; and I left with the rather bitter feeling that I had no share in the undertaking. Ormára, like Gwádur, has a hammer-shaped headland, on both sides of which ships can lie; but, unlike that unhealthy port, it is open to the monsoon, and

consequently enjoys a comparatively good climate. It is the Bagisara of Nearchos.*

Karachi was reached the following night, but after enjoying the director's hospitality for a few days, I once again proceeded up the gulf to Bushire. Upon reporting my arrival, I received instructions from the Legation to join the Persian Governor-General in Baluchistán, so within six hours I engaged additional servants, and with my whole camp found myself once again on board the same mail steamer that I had only quitted a few days previously. Upon arriving at Bandar Abbás, my difficulties were manifold, as it was very late in February, and growing hotter and hotter day by day, while, as no one would hire camels to go to Baluchistán, I was forced to purchase—no easy task. Besides this, I had to engage a local escort, but failed to secure anything better than a few camel-drivers, while not only was it a very dry year, which meant no grazing, but a famine was raging, and everything had to be carried. However, after five days' hard work twenty-three camels were loaded up and despatched, and for the first time I was forced to ride "a ship of the desert," as there was no chance of any forage for horses on the road. The start was nearly disastrous, as eight Baharlus, members of that most unruly tribe of nomads, held up the caravan, which was some miles behind me, and began to loot it. Fortunately the servants rose to the occasion, and when it was known to whom the property belonged, the Baharlus considerately left it alone. One camel, however, took advantage of the confusion to bolt off, and was only found after a day's search.

From Bandar Abbás there are four, or indeed five, caravan routes running to the interior, that to the west through Sirján being the most important, as in that district the Yezd and Kermán roads bifurcate. Next in importance is the route which I approximately followed for some stages; it runs *viâ* Manuján to Narmáshir, and thence to Khorasan *viâ* Neh. The central routes are mainly used in summer by Bandar Abbás-Kerman caravans, and are of less importance; and yet, year after year, commerce is paralyzed on these trade-arteries by a handful of nomads, mainly because the route lies both through the district of Bandar Abbás, and the provinces of Fars and Kermán, and therefore it is difficult to fix the responsibility of the outrages which are ruining both British and Persian trade on to the shoulders of any one governor.

To return to our journey, we did not follow the direct caravan route which passes to the north of Mináb, but, in the first place, visited that centre, with a view to completing our supplies and transport. Mináb, or Minau, as it is pronounced, lies on both sides of a river of the same name, and appeals to every traveller from the fact that it was near here, at Harmozia, that Nearchos landed, and proceeded inland to find

* Chahbár bay, or probably the Tiz harbour, is Talmena, while Gwádur is Barna.

Alexander the Great in the valley of the Halil Rud. This meeting constitutes one of the most dramatic events that history can claim, and is a fit subject for a painter's skill. The town is situated on the left bank of the classic Anamis, and is guarded by a picturesque old fort. It has a population of 5000 inhabitants, and rough woollen plaids constitute its principal industry. There is also a considerable output of dates, henna, and indigo; but it is as the resort of Baluchis and Bashakirdis, who barter clarified butter, wool, and hides for calico and copper, that Mináb is important, the wild sons of the desert seldom venturing to Bandar Abbás, although the inhabitants of the port flock to the superb date-groves during the summer months. Three Haiderabád Mohamedans, born in the district, and a few Hindus appeared to have all the trade in their hands, and told me that tea and sugar were now occasionally bought by merchants. It is evident that the Baluchis are becoming quite luxurious! There was great difficulty experienced in obtaining the five additional camels required, but finally, on March 1, after a storm which brought down dozens of palms, some of which fell into our camp, we started with everything complete, Sultan Sukhru, the plane-tabler, having overtaken me with a last mail. Strangely enough, for two stages we were the first Europeans to traverse what was possibly the route followed by Nearchos, and, when some five miles from Mináb, we nearly had a similar experience, as we met a peasant hurrying in with information that the road was being held up by a body of Márz robbers, who had already looted a caravan that day. However, nothing happened, and after crossing the Gardan-i-Pichal, we camped at Birinti, which is situated just above the junction of the Rudkhána Duzdi, or "River of Theft," * and forms part of the district of Rudán, in Fárs. We followed up the diminished river to Jagin, the Duzdi river being in reality the main branch, and a third march brought us to Manuján, which is situated near the source of the Mináb river, although there is a good deal of drainage from the Mulla Kuh to the west.

Manuján has a fine fort now deserted, and should be a very rich district, the camel-grazing being most luxuriant; but, partly at any rate from the ignorance of the ruling family, a famine had arisen, and deaths from want were of daily occurrence. The information which I received tended to show that the Governor-General was coming in my direction, but when, two stages further east, the Governor of Rudbár came to see me, it appeared that his Excellency had gone on to Fahraj. Durran Khán told me that his ancestors were Arabs of the same tribe as the Kain family,† and that three centuries ago they migrated to Rudbár with their slaves, whose descendants still occupy the district.

* Cf. Sir Henry Yule's note on Reobarles in vol. i. pp. 116, 117, of his 'Marco Polo.'
† *I.e.* of the Khuzai.

MAKRÁN SCENERY.

[To face p. 131.

I was now on the western edge of the only large blank left on the map of Persia, although I afterwards found that Khán Bahádur Yusuf Sharif, the eminent Indian explorer, had preceded me, and as the Governor-General had received instructions to march down towards the coast, my only chance of meeting his Excellency lay in cutting him off, so I decided to traverse the plain of Basbákird. During my second journey in Persia, I had marched to the north of the great *hámun*, known as the Jaz Morián, in which the Bampur and Halil rivers commingle their waters, and had fixed many of the peaks of Bashákird, while the present journey led in an opposite but almost parallel direction, keeping to the open plain as far as Rámishk, a distance of 118 miles from Manuján. I was unfortunate in suffering from a severe attack of fever, probably a souvenir of Bandar Abbás, and had it not been for my Persian secretary, Nasrulla Khán, and my plane-tabler, much would have been lost from a geographical point of view. The whole plain, which is very extensive, was covered with the most luxuriant camel-grazing, and in places there were flocks, but the country was so unsettled that we hardly saw a man throughout. Indeed, Bashákird, the most backward and savage district of Persia, has never been fully controlled by that power, but during the last few years a miserable revenue of £160 per annum has been nominally paid, Durran Khán, who holds the title of governor, practically making a raid into the country and seizing what he can. It is divided into four districts, each of which is assessed for a quarter of the revenue, and they are thus presumably equal in population. Starting from the west, Sindark is the nearest division to Mináb. Eastwards lies Jakdán and then Anguhrán, while Márz occupies the whole of the north, and it is mainly from this division that raiders attack the caravans. Four or five days before my arrival, seven camel-loads of sugar had been seized and an Afghan shot one stage to the east of Manuján, blood still staining the spot when we passed. Unfortunately for the raiders, one load of sugar was the property of a British subject, and six months later I asked the Governor-General for compensation. On his replying that he did not know whom to mulct, I was able to tell him that the *Kalantar* of Rámishk had sold sugar to my party far cheaper than it could be bought at Bandar Abbás!

To resume the thread of my narrative, after nine marches, all of which, except the last, lay across the most level of plains, with foul well water to drink, we reached Rámishk, the exact situation of which had puzzled me for many years. It lies at the junction of two branches of a small river on the outer range of the Bashákird mountains, and consists of perhaps a hundred huts and half a dozen small shops, Rámishk being the capital of Eastern Bashákird. The *Kalantar* was not friendly, and as it was rumoured that our troops and those of Persia at Karwán had been driven into the sea, our position was

somewhat delicate, until the welcome news came that four hundred camelry were on the way from Fahraj, which proved to me that the Governor-General had received my letter, enclosing instructions from the Prime Minister of Persia, and had acted without delay. The very heavy rain which had been drenching us for a week ceased at the end of March, and the heat became so trying that, as everything was being done to capture the murderers of Mr. Graves, I decided not to wait for the arrival of these troops, but to push on to Fánoch, feeling sure that I should get letters on the way. We were now in a hilly district, and, following up the Rámishk river to its source, I was surprised to pass villages and date groves in what I thought was a desert. Crossing the watershed, we camped near a spring, and the following day, after fording a small river flowing north to Isfand, we reached the important village of Kutaich, in the Fánoch district, where I was visited by the Governor's sons, whom I had known for five years.

At this point it may not be out of place to summarize briefly the state of Persian Baluchistán since the assassination of H.I.M. Násir-u-Din in May, 1896. The Baluchis had generally believed that there was no new shah, and the continued absence of a Persian force had, more or less, contributed to foster this delusion. From fear of His Highness the Farmán Farmá, no rebellion had broken out until that strong ruler had left Kermán, but in the following year Sirdár Husein Khán headed a confederacy of Baluchis, who besieged Fahraj. The siege, or, more strictly speaking, the blockade, was not eventful, the only incident being an abortive attempt to mine, which was defeated by a sortie, and after three or four months the Baluchis retired, upon news reaching them that a Persian force was on its way to relieve the garrison. Since that date, Sirdár Husein Khán and his brother Chakar Khán, Governor of Fánoch, had kept quiet, the former generally living in or near a natural fortress, termed the Kuh-i-Mihán, some 30 miles to the south of Kutaich.

As both the brothers knew me, they sent to say that they hoped I would intercede for them with the Persian Government, whereupon I replied that if they had seized and handed over Mr. Graves's murderers, I should have been ready to do so. Already, two months previously, Seiid Khán, son of Sirdár Husein Khán, had promised to do this; but as Baluchis rarely carry out their promises, I felt that it was useless to rely on them, and continued my journey, feeling glad that they had been prevented from arming themselves with martinis, as, were this the case, Persia would have had the greatest difficulty in holding Baluchistán, and even as it is, Sirdár Husein Khán is much at large.

Two stages, during which large villages were passed, brought us into the valley of the Fánoch river, and at last I received letters from the Asaf-u-Dola to the effect that he had acted immediately upon hearing from me, but could not come south in person, being ill; but would

DALIKI.

[*To face p.* 133.

I not visit him at Fahraj? However, I was so weak that I had to be hoisted on to my camel, while the daily temperature was over 100°, and as everything that could be done was already in train, I decided to make for Chahbár as quickly as I could. At Fánoch our arrival at first created a panic, but in a few hours the villagers returned, and supplies could be procured, but only at famine rates—by way of indemnity, it is to be presumed. I was once again on familiar ground, and felt grateful that I had been able to march through Bashákird, which I had gazed across with longing eyes from the summit of the hill above Fánoch some five years previously, while I had on this occasion the great advantage of working partly from fixed points.

We were told on reliable authority that a party of Karwánis were lying in wait for us.; but apparently their hearts failed them, or we were successful in avoiding them, and, after marching down the Fánoch pass, we crossed to the Sirha river, and were soon out of their reach. Daily it grew hotter, while our camels, although fed on dates, gave in one by one, in spite of the fact that our loads were very light, all supplies being finished; and it was with much relief that we struck the British telegraph line at Parag, where we halted for a few hours until the creek became passable. At dawn we passed through the gap of Tiz, a great port in Seljuk times,* and a few hours later, with a single worn-out camel left out of seven that had started in the night, I looked down upon the substantial telegraph station at Chahbár, where I was soon welcomed by Messrs. Wilson and Keelan with the hearty kindness so universal throughout Persia and Baluchistán. A day or two later came the welcome news that the Karwánis, taken in front and rear, had given up their chief, Shai Mohamed, the murderer, and that his accomplice Malik Jind had been shot; thus my mission was finally crowned with success.

In due course of time orders came for me to proceed to Shiráz, and special arrangements were made for a British India steamer to pick me up. After spending a few days at Bushir, we started for Shiráz in very hot weather, the hours we spent at Daliki, at the foot of the famous *Kotals*, being especially unpleasant. Travelling up country, and by moonlight, is perhaps the best way to see this wild maze of mountains, and I never remember anything so grimly savage and frowning

* Afzal-al-Din Ahmad bin Hámid, known as Afzal Kermáni, who wrote in A.H. 584 (1188), gives the following description of Tiz: "There is also the gap of Tiz that belongs to Kermán. Much merchandise from the tenths paid as customs and from the harbour dues reaches the royal treasury. Inhabitants of Hind, Sind, Abyssinia, Zanzibár, Egypt, from the land of the Arabs, from Oman, and from Bahrein trade there. Every description of musk, ambergris, indigo, Brazil wood, and also aromatic roots of Hind are offered for sale; also slaves of Hind, Abyssinia, and Zanzibár. It is a mart for fine velvets, shawls, sashes, and such-like articles of value. Close to Tiz is Makrán, the mine of sugar candy and sugar, which is exported to all countries of the heathen and of Islam." The Arab travellers, however, speak of Tiz as a small port, and Afzal Kermáni is certainly prone to exaggeration.

as the apparently sheer ladders up which British goods are painfully carried. Five years previously I had travelled in the opposite direction as fast as possible to catch a steamer, but on the present occasion I spent a day at Shápur to inspect the rock sculptures, although, owing to weakness, I was unable to visit the cave containing the statue of the great king. At Kazerun we camped in a garden of oranges, known as the Bágh-i-Nazzar, with a superb avenue, the trees in which are said to be four hundred years old, and are perhaps 40 feet in height. A particularly small lime of excellent flavour is also grown, the garden, indeed, producing several varieties both of oranges and limes.

Shiráz, where I stayed for three months, is a city of contrasts. Sir Thomas Herbert evidently left his heart behind when he was forced to proceed on his journey, and certainly the people seem to enjoy life with a zest quite unknown elsewhere in Persia. The gardens at Masjid-i-Bardi which disappointed Lord Curzon would, I feel sure, have won his praise in the summer; nevertheless, the climate does not suit Europeans, and consequently Shiráz has a bad name, although the heat is not excessive. With the aid of my host and future fellow-traveller, Mr. Wood, a piece of ground was rented and polo organized, to the joy of the Shirázis. Even the donkey-boys caught the infection and started the game. Time quickly passed, and after a few days at the Kuh-i-Bamu, where I enjoyed the Resident's hospitality in a valley at an elevation of 6700 feet, I left Shiráz with regret, although until I did so my health was not restored. Two days were spent at Persepolis, and we dined by moonlight where—

> "Those black granite * pillars, once high-reared
> By Jamshid in Persepolis, to bear
> His house, now, 'mid their broken flights of steps,
> Lie prone, enormous, down the mountain-side." †

The following morning a visit was paid to the Sassanian sculptures, the chief figure in which is quaintly described by Josafa Barbaro as "a great ymage on horsbacke, seemyng to be of a boysterouse man, who they saie was Sampson, about the which arr many other ymages apparailed of the frenche facon, with longe heares." ‡

During the summer I had been engaged in collecting Persian references to the ancient game of *Gu-i-chogan*, which, under the guise of polo, I have been instrumental in re-introducing to its ancient home. Among other pieces of poetry and prose was one from the *Shah Náma*, in which Zál, praising Mehráb of Kábul as a warrior, says—

> "In figure, none approach him,
> No one is his peer with the *gu*."

* They are, in reality, limestone. † Shelley's "Alastor."
‡ 'Travels of Venetians in Persia,' p. 81. Hakluyt Society.

These lines appeared to me not to refer to polo, but to a weapon, and it has struck me that the pear-shaped pendant that swings at the royal charger's quarters in these superb rock pictures may have been what is known as a morning star. Against the usual theory that it was a tassel, I would urge that such ornaments are not fastened by chains, that there only appears to be one, and that it is not in every panel, as it would probably be if belonging to the horse-gear. Again, it would not serve its purpose, and, as it was certainly uncomfortable for the horse, it was, in my opinion, either a ball of iron thrown at an adversary, the chain bringing it back, or else it was swung round the head. All Persians to whom I have referred the question accept this version, and many of them term it *topuz*, which is the ordinary word for mace. While on this subject, it is interesting to note that the word *chogan* is still with us in the shape of "chicanery."

Continuing our journey, we rode up the banks of the Polvár, which Varthema * at the beginning of the sixteenth century mistook for the Euphrates, and after spending a few hours at Pasargardae, we ascended to Dehbid, from which place Barbaro branched off to Yezd. At this, the most elevated station in Persia, I enjoyed the hospitality of Mr. Jefferies, and was given an account of the siege sustained at the time of the Shah's death, which would have ended badly for our plucky fellow-countrymen and their heroic wives had not the nomads omitted to cut the telegraph-line. The main postal road through Persia is certainly much more interesting than any other, and supplies can always be obtained, so that, although the sun had by no means lost its power, we much enjoyed the various stages. Abáde, famous for its sherbet spoons, is a really pretty village; while Yezdi-khást, shaped like a steamer, and perched on an inaccessible cliff, is certainly one of man's strangest habitations. On the confines of Isfahán, I was met by the Adjutant of H.R.H. the Zil-i-Sultán, and under his guidance we entered the ancient capital of Persia. Isfahan has been so fully described that I will but mention that, in my opinion, it is by far the most interesting city in Persia, while those who are admitted to an interview with its royal governor can scarcely fail to be struck by his *bonhomie* and urbanity.

The last week in September saw me bound for Nain, where I overtook Mr. Wood, whom I was fortunate enough to have as a companion to Sistán, my destination. At Nain we struck a route that I had travelled in 1894, but I was able to add to my knowledge, as I was told that the fort was known as the Kala-i-Gabr, and even the *Kanats* had Parsi names. At Agda, a village of *Seiids*, the inhabitants claim to be kinsmen of the Parsis, recently converted from the ancient religion. This receives most interesting corroboration from Josafa

* *Vide* 'Ludovico di Varthema,' p. 101. Hakluyt Society.

Barbaro, who, when travelling from Yezd to Kashán, wrote as follows: "Twoo daies jorney further (sc. from Meibut) is a towne called Guerde, in the which there dwell certein men called Abraini, which in myne opinion either be descended of Abraham orells haue Abraham's faith, and they weare long heare." * There is little doubt in my mind that these Abraini—the word being probably a corruption of *Gabr*—were Zoroastrians, who, to mark their conversion to Mohamedanism, were given the honorary title of *Seiid*, just as to-day the title of *Mirza* is generally given.

In the neighbouring hills is situated a shrine in honour of the *Bánu*, or "Queen" of Fárs. This lady was the mother of Yezdigird, and was swallowed up by the earth when pursued by the Arabs. It is an interesting fact to note that, until quite recently, cows were sacrificed at this sanctuary, but the slaughtering was done by Mohamedans, who also ate the flesh.† Ardakán, too, was formerly a great Parsi centre, and the writings of the *Dasturs* of Turkabád are still preserved at Bombay. Apparently they all became Mohamedans some sixty years ago, and now Sharifabád is the only Parsi village in the district. Altogether, this part of Persia preserves many traces of the Zoroastrian worship, while *dari*, the old tongue, stated to be a corruption of *darbari*, or the official language,‡ is used, not only by the Parsis, but also by the villagers and townspeople, as far as Kashán.

At Hujetabád, one stage from Yezd, Mr. Stewart Ferguson, of the Imperial Bank of Persia, rode out to spend the night, and on the following morning we entered Yezd, where we received a warm welcome from the European colony. Continuing our journey, the section to Kermán was also familiar country to me, but, as I wished to show my companion what I considered to be the best line for the Central Persia Telegraph to follow, this was unavoidable.

Upon reaching Kermán, we found the Rev. A. R. and Mrs. Blackett, of the Church Missionary Society, ready to greet us, and the three weeks that were spent at my headquarters were fully occupied with accumulations of consular work and the large amount of visiting that is so necessary in the East.

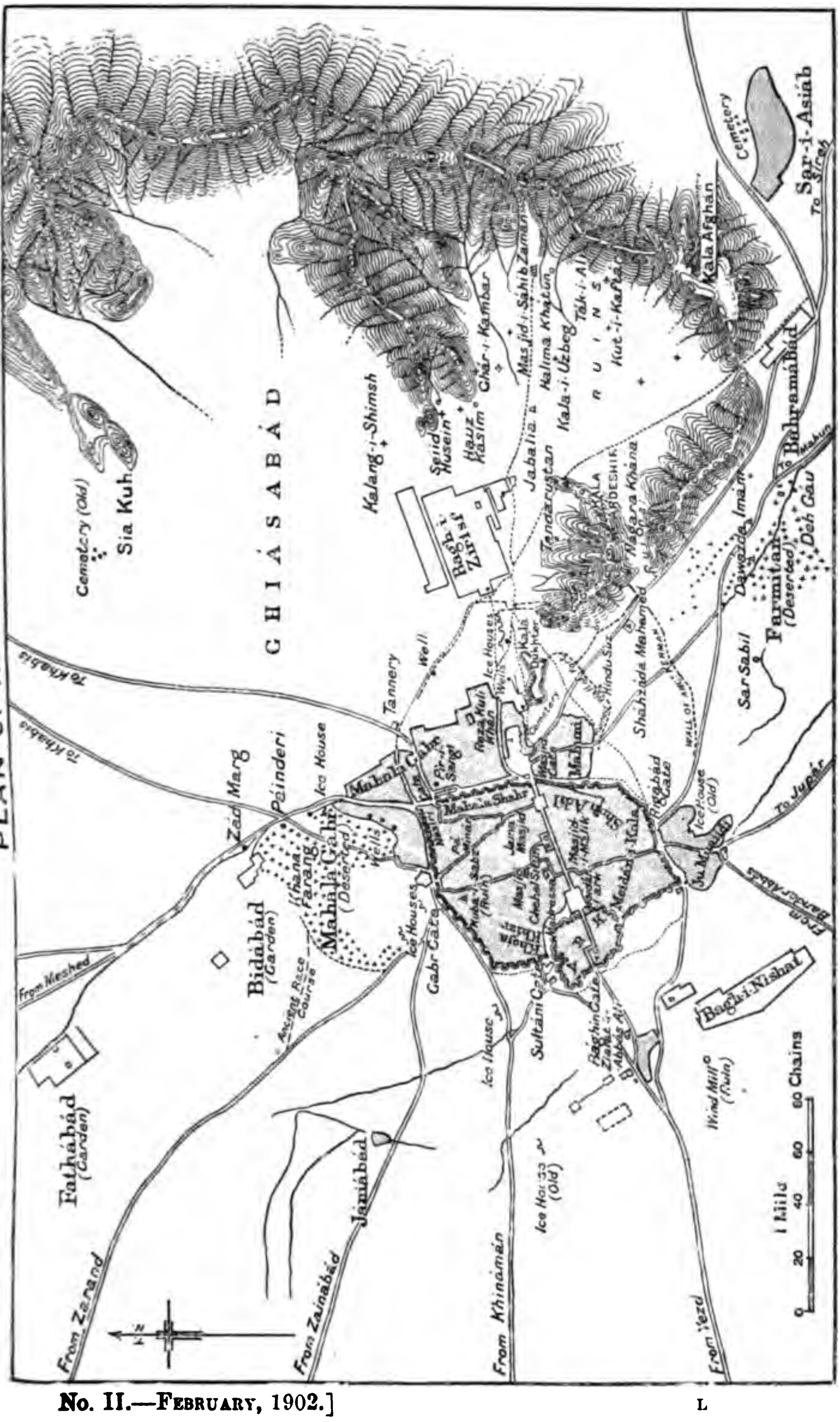
About the middle of November, however, everything was ready, and we marched to Máhun, where, as usual, a day was spent in getting the loads arranged. The caravan route which we had followed before in 1894, and again in 1896, leads across the high and somewhat narrow Hanaka pass, which would be particularly unsuitable for a telegraph

* 'Travels of Venetians in Persia,' p. 82. Hakluyt Society.

† The legend runs that the *Bánu* was thirsty, and a peasant offered to milk his cow for her, but that, when the operation was completed, the cow kicked over the pail, so that the traveller had to continue her flight without quenching her thirst. The sacrifice was apparently an act of retribution.

‡ It may also be derived from *dar*, a gate. Cf. the Sublime Porte.

PLAN OF KERMAN



line; but as for many years I had thought that the line must finally run this way, I had partly explored a route which appeared to be much more suitable, and, although information regarding it was vague, we found that it was open throughout, and perfectly adapted for a telegraph line. The first stage was Zein-ul-abád, and some 10 miles beyond it an almost imperceptible watershed was reached at an elevation of 8400 feet, with a distance of more than five miles between the hills, so that the chief difficulty apprehended was successfully surmounted. In Tahrud, which is the name of a district, and not of a village, we again struck a known track, and after descending the valley for three stages we reached Bam, where we halted for two days, as there were many calls to receive and return, while our complement of running camels, which are almost a necessity for the desert, had to be made up.

Bam, with a population of 13,000 inhabitants, is a most prosperous town, being, as it is, the great henna centre, while with its new *bazárs* it presents a very different appearance to what it did at the time of the Sistán Mission: its altitude is 3400 feet. We marched somewhat leisurely across Narmáshir, enjoying to the full the greenery and the excellent shooting, and halted at Rigán for a day to engage extra camels for the desert that lay before us.

My companion was instructed to proceed to Ládis, and for this reason, in addition to the fact that I hoped to meet Captain Webb Ware on the frontier, we decided to march to Kwásh, as I knew that there was a fairly easy route running across the desert. A Persianized Baluchi chief and six of his followers were engaged as guides, and after camping at Deh Yaghi Khán, on the eastern edge of the Narmáshir oasis, we filled up our water-barrels and entered the desert. The first stage was waterless and destitute of forage for the camels, but the following day we found very fair water at Chah-i-Ráis. Throughout these desolate marches it was evident that we were in a volcanic region, which the name Dahána-i-Bulbulak, or "Volcano gorge," corroborates, while at Chah-i-Ráis we were only some 40 miles to the north-west of the Kuh-i-Bazman, the extinct volcano which I had climbed in 1894. We crossed the northern prolongation of this mighty range and camped at Sam Sor, on the bank of a salt river which, taking its source close to our camp, flows approximately west-north-west to the Shurgaz *Hámun*. The river was full of reeds and 30 yards wide, flowing in a sluggish stream between high banks, and as sweet water was to be procured some 15 miles distant, we decided to halt a day and try for a wild ass. However, our camels had frightened off that most timid quarry, and although we saw two we could not get near them, as they were thoroughly alarmed. The next stage brought us to the foot of the black range which, running approximately from north to south, holds up the Sarhad plateau, and after a very long day we crossed this mountain barrier and tasted almost sweet water at Jauri.

temporarily quitted me, and travelled due west to the Galugán plain and the Rud-i-Máhi, while I proceeded north-east, and in three stages struck the trade route to Kacha Kuh.

I now propose to make a few remarks on this, the western frontier of our great Indian Empire. As one result of the Durand mission to the court of the Amir in 1893, the Afghán-Baluch boundary was delimitated by Captain McMahon, a difficult piece of work occupying two years. Coinciding with the second year of this delimitation, in 1896, the Perso-Baluch Boundary Commission, as it was inaccurately* termed, under Sir T. Holdich, a Vice-President of this Society, whose assistant I had the honour to be, fixed the boundary between Persian and British Baluchistán. The Government of India thus became responsible for a large slice of desert hitherto the resort of desperate raiders who had driven away all peaceful inhabitants. Owing to the award of the Sistán Mission, a triangular strip of desert lies across the most direct Quetta-Sistán route, while Afghanistán, being a sealed country, bars all access to the Helmand, and as from Sistán to Nushki, a distance of more than 500 miles, there is not a single village or hamlet, few districts offered less promise. However, the action of the Government of India in remitting all tolls and customs, and in finally buying up the rights of the Khán of Kalát, whose representatives were not progressive, gave the needed impulse; while Captain Webb Ware has not only dug wells and built huts at every stage, but is placing *bannias* at the more important posts along the route, who are bound to keep and sell supplies at a moderate rate. A weekly postal service, which has since become bi-weekly, has also been instituted, so that, as far as Webb Ware was concerned, everything was being done to attract trade to British territory, while my mission was, partly at any rate, to report and make recommendations as to the best means of assisting and protecting commerce in the wild regions of Eastern Persia.

To return to our journey, Webb Ware had sent me three letters to various points of the frontier, and from them I learned that he could not reach Robát Kala until the middle of January, and also that a small escort was on its way to join me. I consequently halted until the escort came in, when we continued the journey in cold weather, registering a reading of 24° at 8 a.m. on New Year's Day, 1899. The road wound up and down an interminable maze of defiles, but these have since been avoided by the selection of a better route, and on January 2 we reached Robát Kala, which looks like a border tower, framed in a background of frowning mountains. Unfortunately the camel-grazing is indifferent, although the water is good enough; moreover, the surrounding country is a mass of black

* The Persian commissioner more accurately termed it the Perso-Kalat Commission.

hills and watercourses, and I am afraid that time will elapse before population springs up round this our most westerly outpost. A few miles to the north we passed the somewhat insignificant black hill of Kuh-i-Malik-Sia, where the Indian and Persian Empires actually touch Afghanistán, and at Hurmak my companion rejoined me, after having travelled north *viâ* Duzdáp, or the "Thieves' Water."

SKETCH MAP OF SISTÁN

When we resumed our march we entered the flat stoneless plain of Sistán, which seemed quite as strange to us as dry land feels after a long voyage. Some 30 miles from the British frontier we crossed the Shela, a deep watercourse 350 yards wide, with high cliffs. In modern times it merely carries off any superfluous water from the great

lagoon or *hámun*, which overflows once in seven years on an average. As, moreover, the Zirra,* the *hámun* to the east, is quite 100 miles long, it is evident that at some probably remote period all the waters of the Helmand drained into it. Unless this were the case, the great width of the river-bed, its 40-foot cliffs, and the huge area covered by the Zirra, could hardly be accounted for. At the time of our crossing there were a few large pools of green water in the Shela, which has erroneously been termed *Shelag*, the word being Arabic for a body of water.† The fourth stage from Robát Kala lay through a part of Sistán which had formerly been fed by a canal from the Helmand, taken at a point now in Afghán territory. It teems with memories of Rustam, the great hero, two mounds, at least a mile apart, being pointed out as the manger and heel-ropes of Raksh, his "lightning" charger, while Hauzdár was the scene of the execution of Faramurz. It now consists of a walled town in a good state of preservation, deserted about a hundred years ago, when the Sarbandi tribe seized it by treachery and ousted the Ráis tribe, which is said to represent all that is left of the famous Ghaz who defeated and captured Sultan Sanjar.

I have been much struck by the resemblance between Sarhad and Palestine on the one hand, and Sistán and Egypt on the other. When we traversed Sarhad, the districts which I had seen in 1893, dotted with nomad tents, were now deserted, and the Sarhaddi, who much resembles the Kafirs described by Sir George Robertson, was rarely to be met. Upon making inquiries, the invariable reply was that they had gone to Sistán in consequence of the drought, as there alone could their families and flocks be kept alive. Upon entering Sistán, which is, it must be remembered, fed by a river that fails as rarely as the Nile, and is in consequence the granary of the surrounding tribes, I was struck by the vivid parallel between these Sarhaddi chiefs who left their highland home and crossed the desert to Sistán, and Sheikh Ibráhim and Sheikh Yakub who, thousands of years ago, quitted theirs in Palestine to find sustenance in Egypt.

As I have said above, Sistán depends on the Helmand, but hardly in the same way that Egypt depends on the Nile, as not only does the Helmand, or Hirmand, as the Persians term it, pass through Sistán, but that district receives the entire discharge of its waters. Accordingly, I propose to give a summary of the various routes taken by the Helmand in historical times, as without some consideration of this question much in Sistán remains obscure. To begin our survey with the fourteenth century, there was a great dam known

* A contraction from the ancient Zarangia, or Persian Sistán, while Sakastani was the district to the east. A friend suggests that in the word "Sakæ," we have perhaps a clue to the origin of "Saxon," a word which is so puzzling.

† Cf. the *Mashela*, which separates Bushire from the mainland.

KUH-I-KHOJA, SISTÁN.

[To face p. 143.

originally as the Band-i-Rustam and later as the Band-i-Akwa * (evidently a corruption of Afghán, or Agwan), whence a canal or canals were drawn, fertilizing the district now covered with ruins, through which we passed to the south of Sistán. The main stream ran north, and was known as the Rud-i-Nasru, Shahristán and Zahidán being cities on its bank. These conditions were changed when Timur destroyed the dam, which is said to have been built of stone and cement. As a result, the Hauzdár district to the south gradually went out of cultivation, and the Helmand, while still keeping to the Rud-i-Nasru, created a channel for its superfluous waters, which encircled the three hills of Sehkuha, hitherto not inhabited. The river approximately followed this course until early in the nineteenth century, when the whole volume of water carved out a new channel to the west of Nád-i-Ali. As this left cultivated Sistán high and dry, the Rud-i-Sistán was cut a little to the north of Sehkuha, a task of great magnitude, which was more than once abandoned before being finally accomplished. This was the state of affairs until recently, when the Helmand began to forsake the Nád-i-Ali channel, breaking across Mián Kangi in various places, and in 1896 a regular channel, known as the Rud-i-Perián, was formed, destroying Jahanabád, Ibrahimabád, and Jalalabád. A glance at the sketches will show that this new course is not far from the ancient Rud-i-Nasru, to which it is expected the wayward river will finally return, although perhaps with a smaller stream, the volume of water decreasing decade by decade.

To resume, seldom was any party more glad than we when we reached Varmal, the southernmost village of Sistán, as the supplies for which we had sent on ahead had missed us, and we had neither flour nor forage left, so that to be once again in a land of plenty was very pleasant. We were about a mile from the *hámun*, and, strolling across the treeless expanse to its edge, saw the surface of the water covered with wild-fowl of every conceivable species; when they rose, there was a roar like surf beating on a rock-bound coast. We marched to Nasratabád,† the capital, where the governor rode out to meet us; but after four days we returned to Varmál, where we met Captain Webb Ware and also Mr. Tate, both Fellows of this Society. As may be imagined, the two days that we spent together were all too short, as both Webb Ware and Wood had to return southwards, while Tate and myself proceeded to the Kuh-i-Khoja.

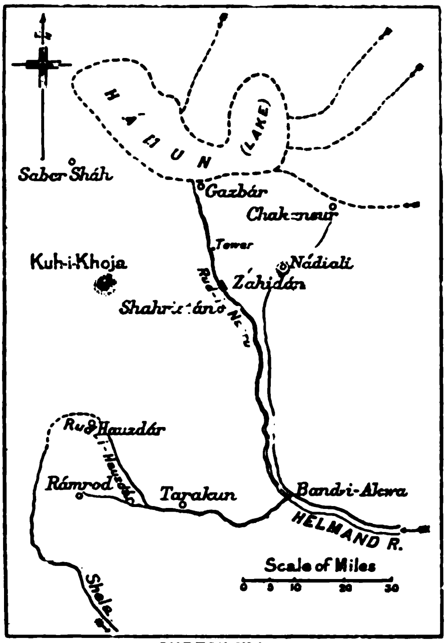
From Varmál a ride of 18 miles brought us opposite what, in the British Empire, would certainly be termed "Table mountain." ‡ To

* *Vide* sketch-maps on pp. 144-5.

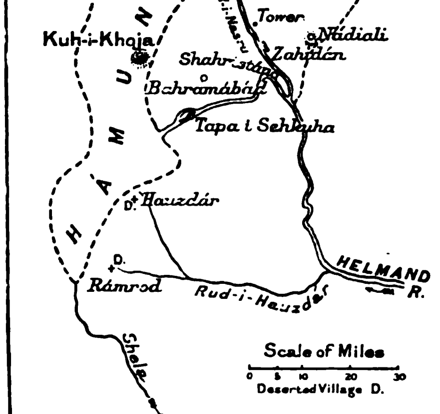
† The name Nasirabad is not used nowadays.

‡ When at Bulawayo I visited the well-known Thabas Induna, which, in the distance, closely resembles the Kuh-i-Khoja. On its summit Mozilikatzi, father of Lobenguela, dealt out grim justice.

reach it we had to traverse the *hámun*, which was perhaps two miles across, and at most four feet deep. There were scarcely any reeds in this portion, and what there were afforded no cover, nor was there any game except thousands of coots, known as *chur*. We waded into the shallow water and climbed on to *tutins*, or rafts composed of bundles of reeds, resembling a bisected cigar, and were slowly punted across the shallow lagoon. At our landing-place were the ruins of Kakkar, consisting of numerous buildings, situated round a square, while, winding up a cliff, a ruined road brought us to the summit at Kuk, the fort protecting Kakkar. The Kuh-i-Khoja, originally known as Rustam's hill, rises some 400 feet above the level plain, and as it is the only object that breaks the even monotony is, not unnaturally, famous in legend and history. In the former category, it may be mentioned that the capture of Kakkar and the slaying of Kuk, its king, was Rustam's first exploit; while in modern times, it resisted all efforts at capture by the forces of Nádir Shah for a period of seven years, after which peace was made. The hill in shape resembles an apple, and is higher at the edges than in the centre. It has evidently been mined, as there are great pits, some 40 feet deep, while thousands of tombs, consisting of mud domes, hollow cairns or pillars, occupy a large portion of the summit, the graves



SKETCH No I

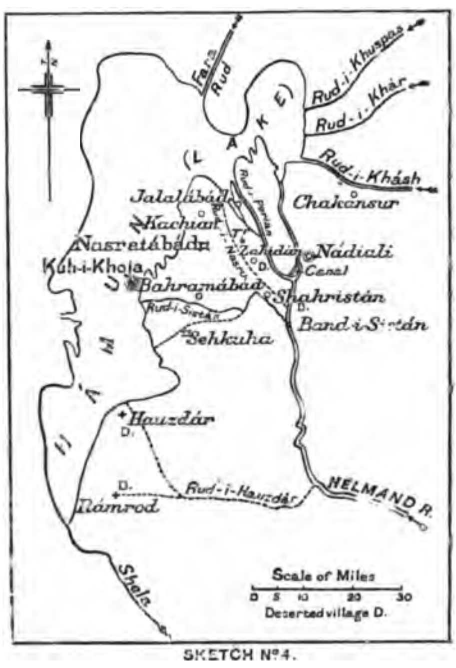


SKETCH No 2.

being all above ground. The *Khoja*, or holy man, who gave his name to this hill in supersession of that of Rustam, was termed Ghaltun, and there is a small shrine in his honour. There is also a building termed Ziárat Gandum Pirán, which is visited at the vernal equinox, when wheat is burnt and thrown over the shrine to ensure a good harvest. At this season there are also races, together with "putting the stone," and it seems probable that these customs date from pre-Mohamedan times. At the south-west corner we found a patch of yellow sandstone, covered with stones resembling peas congealed together, of which specimens were taken: they proved to be botryoidal chalcedony.

SKETCH N°3.

Tate left me the following morning, after far too short a visit, as for six months I was not destined to meet another fellow-countryman. As soon as possible I began the systematic examination of Sistán. My plan was to move the camp some five miles twice a week, in order that every portion of the district might be examined without difficulty. I started with the southern section, visiting Sehkuha, which in some maps is shown as the principal town * in Sistán, whereas nowadays it is comparatively insignificant, although the



SKETCH N°4.

* As a matter of fact, there are no towns, and less than a dozen large villages, in the district.

picturesque old fort contains a garrison of fifty soldiers. We crossed the Mádar Áb or Rud-i-Sistán some five miles below the dam, the horses swimming and the camels just being able to touch the bottom, and the following day we visited the Helmand. At the dam it is perhaps 400 yards wide, flowing fairly fast between low sandy banks, and was a most refreshing sight, rivers being scarce in Persia. The dam is a fragile lattice work of tamarisk stakes, with small fascines fixed in between. Its strength, in a sense, lies in its weakness, as the river flows through it, although quite enough is diverted to fill the Rud-i-Sistán, while the low banks and friable soil would not support a masonry dam, which the river would probably avoid. As soon as the river rises it breaks, and when the floods subside Sistán has to depend on wells for its water-supply until the *band* is repaired.

Another object of interest was Shahristán, a huge old mud fort. It lies on the left bank of the Rud-i-Nasru. Lower down was Zahidán, which was evidently a place of great strength. Legend has it that it was at the siege of this city that Timur was wounded by a tamarisk arrow, and so gained his soubriquet of *Lang*, or "Lame." * I have seen it stated by previous travellers that the ruins of Zahidán extend for 14 miles, but the fact is that there were villages lining the Rud-i-Nasru throughout its length, and these have been mistaken for suburbs of the capital of Sistán. To the north of Zahidán, the fort of which enclosed an area 600 yards square, with a keep of 180 yards square, is a pillar constructed of kiln-burnt bricks, known as Mil-i-Kusanak. It is now some 60 feet in height, with a base circumference of 55 feet, and has two belts of Kufic inscription, both of which, to my eyes, seemed to be the Mohamedan confession of faith. There is a spiral staircase, and the column is said to have been a *minar* belonging to the mosque of Arvakin, he ruins of which town are close by. The members of the Sistán Mission mention a similar tower at Damghán.

Towards the end of February we returned to Nasratabád, which is a permanent camp surrounded by a high wall, with one corner fortified. Just outside is Huseinabád, a village of some three thousand inhabitants, which is generally regarded as "the city," Nasratabád being mainly inhabited by the garrison, who ply various trades in the *bazárs*. It is interesting to know that these villages are believed to occupy part of the site of the ancient Zirra.

Sistán is governed by the family of the late Mir Alum Khan, Amir of Kain, and although it has been in their hands for thirty years, not the slightest effort has been made to improve what is naturally one of the richest districts in Persia, which is in as backward condition as Baluchistán. As an instance of this, I may mention that no vegetables,

* In A.H. 764 (1362) Timur entered Sistán as a fugitive, at the head of a thousand horse. He took many villages, but, being wounded in his hand and foot, retreated to Makrán. It is therefore improbable that he besieged Zahidán on this occasion.

not even onions or potatoes, are grown, while there are very few gardens, as the headmen of the villages enjoy but a yearly tenure, and consequently have no interest in improvements. As may be supposed, the villages, which are built on refuse heaps and yearly rise an inch or two, possess no good buildings, and even the Governor's house compared unfavourably with those inhabited by small landowners in other parts of Persia. The climate, according to universal testimony, has much improved of late years, and must have been somewhat trying before, as we had a temperature of 92° during March, while in early April the flies by day and the mosquitoes by night rendered existence unpleasant to man and beast alike.

As the weather was growing hot, while not more than two-thirds of Sistán had been travelled over, early in March we commenced our second tour, striking the edge of the lake at a point due north of Nasratabád. We were now able to examine a different section of the *hámun*, as for many miles the shallow brackish water was covered with high bulrushes, rising to a uniform height of 10 feet above our heads. Engaging rafts, we were poled down an open passage about the width of a carriage drive, and heard the notes of countless birds, while hawks of every species hovered above. The first bird that we bagged was blue, with a red beak and rather long legs; it is termed a *bostáni*, and is good eating. Afterwards duck of various sorts rose, offering ideal shots, but difficult to pick up in the thick jungle. My poler told me that there were four hundred families of fowlers, or *Saiáds*, as they were termed. They pay half a crown per family as a tax, together with 3 lbs. of feathers, the collection of which is a great industry in Sistán. Nets held apart by stakes are set, and as the birds feed across them a concealed fowler pulls a string and takes the bird. The *Saiáds* appeared to be a class quite apart, and it is possible that they are the original inhabitants of Sistán, as when Timur swept the province clean they could have concealed themselves in the *hámun*, where pursuit would be impossible.

Further east, at Gazbár, which is the best centre for shooting, we saw large flocks of geese, many of which we shot by the simple plan of firing a volley among them from a distance of some 400 yards, one volley resulting in a bag of three birds.

At Jalalabád we were on the bank of the Rud-i-Perián, and as the flood had commenced, the crossing to Mián Kangi * was anxious work. The river, which is divided into several branches, was flowing with a swift current, and was nearly four feet deep, the main stream being a quarter of a mile wide. We engaged several men to support the loads on each side, and, to our great relief, only one camel fell, which was almost marvellous. Mián Kangi is of quite a different character from the rest of Sistán, being covered by a dense tamarisk jungle, in which

* Said to be the equivalent of Mesopotamia.

the villages are mere clearings. We rode to the Tapa-i-Tilai, the frontier where the Helmand, until quite recently, discharged its waters, and found a bare waterless desert, covered with the roots of perishing reeds, and affording yet another example of what water means in these dried-up lands. We marched south with the greatest difficulty, as the numerous canals were hardly practicable, the guides being up to their chests in water. At Takht-i-Pul, and again at Karkusha, are ancient ruins, with splendid kiln-burnt bricks, 24 inches by 17 inches in size; but no coins or seals were forthcoming, although both sites were said to have been Keiani cities. We sighted Nád-i-Ali, the Afghan frontier post, across the Helmand. It is built on a conspicuous mound; its ancient name was apparently Nokoi,* and it was only repeopled and renamed some sixty years ago or less. Close by, to the south, are the ruins of Amirán, or Mirán, where Greek and other coins and seals are found after heavy rain.

At Milak the Rud-i-Perián flows in a single channel 300 yards wide, and for perhaps 50 yards the river is swift and deep. Rafts were procured on which our gear—to use the comprehensive naval term —was stowed, and the horses swam across, but not without difficulty. Each camel had four gourds tied on to its back, and a swimmer towed the "ship of the desert" in front, while a second man sat on its tail, presumably to prevent a capsize. The *oont*, as Thomas Atkins terms it, was thus pulled across, not making, as far as could be seen, the slightest effort to swim, but passively submitting, with an air of dignified melancholy.

Early in April the whole of Sistán had been examined, and preparations were made for the move to the province of Káin. As there were several stages in front of us where forage could not be procured, both flour and barley being imported from Sistán, it was decided to take a two months' supply with us, which necessitated hiring a hundred camels in all. The next question of importance was whether the *hámun* would be covered by the steadily advancing flood, or whether we should be just in time. By good fortune we found that, although the direct road was closed, yet by making a slight *détour* we could avoid the water. After a short stage to Afzalabád, situated on the eastern shore of the lagoon, we started off some two hours before sunrise, and when it grew light we could see the Kuh-i-Khoja to our south, while off the road, on the western shore of the *hámun*, was the Mil-i-Nádiri, or "Pillar of Nádir," a mud tower which was perhaps used as a signalling-post by that great soldier. At Beiring † we camped on the west edge of the lake, and our horses, although covered up, were nearly driven mad by the grey flies until the famous hot wind began to blow, and we revelled in the thought that we were leaving Sistán just in time.

* *Vide* 'Eastern Persia,' p. 299.

† This is a local word for a mound, according to Dr. Bellew.

Thirty-three miles of desert with a solitary tank, empty for nine months in the year, lay between us and the village of Bandán, which guards the entrance to the hills. We were told—and I quite believe it—that the loss of life on this stage was very great during the summer. At Bandán there is a palm-grove—there are no palms in Sistán—and the heat is said to be terrible, as the low hills both radiate the sun and shut off the wind. From this village we rose steadily to the desert stage of Gisha, and another march brought us across the range dividing the hot and cold countries, while on the seventh day after leaving Nasratabád we reached Duru, and were once again free from the heat and fly torment.

The district of Káin entered at Bandán consists mainly of a backbone of hills running from north to south. On the west lies the Lut, on the east the Dasht-i-Náumid, or "Desert of Despair," while to the south the ranges sink down to the Sistán basin or again to the blighting waste of the Lut. There are no perennial rivers in the district, the drainage flowing to the low levels of the desert, but great river-beds attest the fact that at no remote period the volume of water was much more considerable, M. Khanikoff having traced the bed of the Birjand river for hundreds of miles across the Lut. As a corroboration of this fact, I visited perhaps twenty hill forts in the province, all of which had tanks, but none of these held a drop of water. At the same time the rainfall is greater than that of Kermán, the population depending to a large extent on *deimi*, or crops which are not artificially watered.

Káin has been traversed, mostly by the same routes, by more than one traveller, but we were the first party to explore it systematically. On our arrival at Duru we dismissed most of our camels, and thenceforward the camp was moved by relays, which not only economized money, but gave time for the survey to be carried out, as in Eastern Persia it would not be advisable to leave the surveyor far from support. We climbed the Kala Kuh behind Duru, and on its summit found the ruins of a fort built of stone and excellent cement, with several tanks. The village chief, whose ancestors came from Bokhára, told me that the fort was the work of Hoshang, of the Peshdadian dynasty, which is improbable. From its crest we had a splendid view across the "Desert of Despair," which forms so good a Perso-Afghán boundary, and, looking to the south, we could trace our route for many a mile.

At Huseinabád, where the Birjand and Tabas * roads bifurcate, the smell of the assafœtida plant, then in flower all over the plain, was almost overpowering, and we were glad to move on to Tabas, the chief village

* The district must not be confounded with the Tabas which lies about halfway between Yezd and Meshed.

of the district of Sunnikhána, lying in a well-watered plain, and, as the name implies, inhabited by Sunnis. The fortress, although much dilapidated, was said to be very ancient, and was formerly known as Kala-i-Mazinán. Tradition has it that Mazinán was a general of Alexander the Great.

From this rich plain we proceeded to Birjand, as I wished to be settled down before the month of Moharram; so, leaving the main camp behind, we marched due west to Furk, which, lying at the entrance to the Mainabád range, possesses a most romantic-looking stronghold situated about 500 feet above the valley on an isolated spur.

The following day we passed through the important village of Dar Mián, a corruption of Darra Mián, or "in the middle of the valley," and steadily rose, passing numerous hamlets, until, at rather over 7000 feet, we reached the watershed of this range of rolling hills, which are unlike anything I had hitherto seen in Persia, and are uniform in character right up to Káin. For miles we passed through tulips and hyacinths, and the gardens being one mass of bloom and the climate delightful, we certainly saw the district at its best.

Descending the western slope of the range, we looked across the valley to the high Bakarán hills, under which many villages were nestling, and on May Day we halted at Bujd, a Sunni village. The following morning we entered Birjand, the Amir's brother riding out to welcome us. The town is situated on both sides of a wide bed, and covers a curious range of small rounded hills running down the centre of the valley. Its appearance is unpleasing, owing to the absence of the trees and gardens which grace almost every village in Persia, while its single *kanat* is salt, and all drinking-water is drawn from tanks, which are filled by bringing down streams from the hills. Lying in a sterile valley, Birjand draws most of its supplies from Sunnikhána, and owes its population of 15,000 inhabitants to the fact that it is a distributing centre for Western Afghanistán, as well as the seat of government. The climate is cold and bleak in winter and hot in summer, but close at hand are numerous hamlets in the Bakarán range, where it is always agreeably cool.

The Bágh-i-Zirishk, which, as its name implies, is full of barberry bushes, was placed at my disposal, and three days after my arrival, I received the visit of the Shaukat-ul-Mulk, Amir of Káin, who is almost the last of the semi-independent chiefs of Persia. Of Arab descent, and aged about forty-seven, my visitor gave me the impression of a much older man, and his accounts of the days when Turkoman, Afghan, and Baluch raids were in full swing made me marvel that there was any population whatever left to harry, although no doubt return forays prevented the evil from being overpowering. As may be supposed, the Amir is rather behind the times, and he expressed surprise at the opening of the Suez canal, while the idea of wireless telegraphy quite

upset him. He told me that he was a member of the Khuzai or Khuzaima tribe which had originally come from Bahrein, and that in the family circle they still spoke a patois of Arabic, which was also to be heard in the Birjand bazar. As the elder brother of the Amir rules both Sistán, Tabas, and Tun, the southern portion of Eastern Persia is entirely in the hands of this family, which is, however, disunited, as is so often the case in the East, the two Amirs being half-brothers.

May and the beginning of June were spent at Birjand, during which period we gained an insight into the very patriarchal form of government, and also visited the surrounding country. As the weather grew hot—84° being registered at 8 p.m. one night—we made inquiries about hill stations, and finally fixed upon Duruksh, 40 miles to the east-north-east, which was said to be cool, and, besides lying in the centre of an unexplored district, was also conveniently situated for my consular work. In addition to this, it is the home of the Káin carpet-weaving industry, and is fairly close to Tabas, so that the cost of forage would not be excessive. Our first stage was Rahnish, situated 15 miles to the east of Birjand on a *nala* draining into its river, and the following day we crossed the northern continuation of the Mainabád range by an easy pass, known as the Gudár-i-Sar-i-Chah, from a large village of that name situated in a valley sloping down to the Fákh Rud, which, draining a somewhat large district, and passing through Tabas, discharges its flood-waters into the Dasht-i-Náumid. I mention the fact as even the latest maps are most inaccurate on this head.

Descending past hamlet after hamlet, we rode through an encampment of nomad Arabs, and finally reached Gásk, where Khán Bahádur Asghar Ali was awaiting me. In the morning, leaving him to connect Gásk with Tabas, we swung north, and, crossing the Fákh Rud, entered the hills among which Duruksh lies. After marching for a few miles we saw a narrow valley full of ripening crops, on the east side of which lay Asiabán,* a large village of two hundred houses; and two miles further up was the village of Duruksh, where we found our camp pitched in a small garden. At first, we were not at all attracted by this hill station, as the noon temperature was 90°, and this at an altitude of 7000 feet; but in a few days a north-east wind sprang up and made the climate cool enough.

Duruksh, the head of a considerable district, consisting of fifty-one villages and hamlets, contains two hundred and twenty houses, the name being explained as a corruption of Darra Raksh, or the "Valley of Raksh." † Above it, for two miles, the narrow valley is filled with gardens, in which the peasants appeared to spend most of their time

* Lit. a miller.

† Raksh was Rustam's great war-horse, as mentioned above.

during the summer months. The village boasts of a mosque, said to have been built by the Uzbegs,* but it is as the centre of the carpet trade that it acquires importance. In the district there are 450 looms at work, about a quarter of which, including all the best, are at Duruksh. I regret to say that aniline dyes are generally used, although the difference in cost is not appreciable; the result being that, instead of the lovely colours which formerly distinguished a Káin carpet, the eye is offended by glaring scarlets and greens. However, a few of the best master-weavers still cling to the vegetable dyes, and a reaction, which I did my best to foster, is slowly setting in. The patterns are conventional flowers, and occasionally masks, but the quality is not as fine as that of the exquisite products of the Kermán looms. The great bulk of the carpets are bought in Meshed and sent to Vienna, where their cheapness, I presume, secures a market.

Towards the end of June I was gladdened by the appearance of Lieut. Wyatt of the Royal Garrison Artillery, who, with a hospital assistant, had travelled through the heat from Quetta, having covered the distance of some 800 miles in thirty-eight days—a record which is not likely to be broken.

Early in August the exploration of the district round Duruksh was completed, and we moved our camp to the north, crossing an elevated plateau to Shahkin, which was formerly the chief village of the district. Shahkin has a population of rather less than a thousand, and is situated at exactly the same elevation as Duruksh; but the next stage lay steadily down a wide valley, crowded with villages and fields of beetroot, and at Khushk we felt a considerable difference in the temperature. A third long march, during which we quitted the wide valley draining into the Shur Rud and skirted the picturesque Kuh-i-Várizk, brought us to the wide plain on which Káin is situated. Approaching it from the south, a mass of gardens are passed, and the city is seen with a conspicuous mosque—the Majid-i-Jáma, a very ugly erection — rising above dilapidated walls. It is in a state of decay, and has a population of some 6000 inhabitants, a considerable percentage of whom are *Seiids*. Its staple product is saffron, with which it supplies almost the whole of Persia.

Lying in a fertile district, opposite passes in a rugged range, Káin is undoubtedly a site of great antiquity; indeed, it is said to be the Artakauan † mentioned by Arrian as the city at which the princes of Herat took refuge from Alexander when he pursued them. The identification seems possible, and, even to-day, Herát-va-Káin almost

* The Uzbegs held Eastern Persian for two centuries before the rise of the Sefavi dynasty.

† Cf. Ἐντεῦθεν Ἄρεια σχοῖνοι λ'. Ἔνθα Κανδὰχ πόλις καὶ Ἀρτακαύαν πόλις καὶ Ἀλεξάνδρεια ἡ ἐν Ἀρείοις (Isidoros of Charax, 15).

sounds the same as Artakauan. If this identification be accepted, then the World's Conqueror travelled by Shahkin and Duruksh to Tabas Sunnikhána, where tradition has located him, as mentioned above. Personally, I am of opinion that the Sistán of to-day was not visited by Alexander. A glance at the map will show that, owing to the great bend of the Helmand—the importance of which does not appear to have been studied in connection with many problems—Sistán lay much out of the way; and I would suggest that from Tabas, Fara* was made for, and that the Helmand was struck at or near Girishk, where I would locate the Euergetæ.

To return to Káin, on the range to the south-east of the town we examined the ruins of an important fort, occupying the summit of two hills rising some 500 feet above the valley. The main entrance is on the south-east side, and, passing a massive guard tower, the first line of bastioned walls is entered: thence there is a slight rise up a track skirting a tank which is partly hewn out of the rock and partly faced with stone. A second guard-house was then passed through, giving admittance to the second line of defence, there being a steady ascent throughout. This is filled with remains of what were evidently barracks; and a further rise of 30 feet leads to the keep, round which is a third line of bastioned walls built of unhewn stones like the others and set in mortar, and also faced with the same material. This *reduit* is said to have been an ancient Parsi stronghold, while the lower portions were the work of Kerim-ibn-Jamshid, who also built the mosque; the date on the latter is A.H. 796 (1393).

I had intended to make Káin my most northerly point, but, to my amazement, I found that the range enclosing the northern side of the valley was pierced by a gorge which carried all the drainage of Nimbuluk into the Rud-i-Shur, whereas it is shown as a solid barrier in the map. I therefore decided, after Wyatt had left me for Kermán, to explore Nimbuluk † and to carry up the survey to the range dividing Káin from Gunabád, which had the advantage of enabling me to connect my work with that of my first journey, when I had passed through the latter district on the way to Tun and Kermán. We crossed the range by the pass used by the Sistán mission, and, after filling in the western section of Nimbuluk, halted for some days at the important village of Dasht-i-Piáz which is situated opposite the two passes that cross the range to Gunabád.‡ Both it and Khidri, two miles to the south, are mainly inhabited by Arabs. We then returned

* Cf. note *, p. 156.

† Literally "Half-district." Cf. Nimruz, or "Half Day," the ancient term for Sistan.

‡ The most westerly pass is known as Darakht-i-Benna, or "wild pistachio tree;" then comes Sulimáni, which is easier and more direct. To the east there is the Gudar-i-Abbasabád, leading to Khaf.

to Káin by the direct road, passing through the Dahána-i-Karkáb, which carries the entire drainage of Nimbuluk into the plain, where it unites with the "Salt river."

It was now September, and the heat was less trying; we therefore set to work to complete the exploration of the hills lying between us and Birjand, having, as the open plain with very few villages lay to the west, practically examined everything of importance. At Sehdeh, halfway between Káin and Birjand, we found ourselves in a centre inhabited by the followers of Agha Khán,* who number a thousand families in the province. Their chief is a young man, called Morád Mírza, but the sect appears to be rather on the decrease.

By the end of the month we had reached the area of work done from Duruksh, and so returned to Birjand, where camels had to be engaged, my instructions being to return to Sistán and thence to Kermán. I was naturally anxious to visit the country to the west of the route I had followed when marching up from Sistán in the spring; but, this being out of the question, I finally decided to march south-west to the pre-Mohamedan mines of Kala Zarri, on the edge of the Lut, as, by traversing all the valleys, I should be able to find out which was the main caravan route to Meshed, a point hitherto not clearly known, while I could also visit the important town of Neh. After retracing our steps to Bujd, we continued to march parallel to the Bakarán range as far as Mud; then, quitting the direct road to Sistán and Neh, we marched south-west towards the hills, passing some delightful garden villages, and finally crossed the Bakarán range by an easy pass, at an altitude of 7300 feet. Hearing of a wonderful cave that lay off the road, we determined to explore it; so, after a cold night spent at an elevation of some 7000 feet, we started off to find Chinishk. Leaving the main valley at Rask, we bore almost north, up and down rough torrent beds and along the edge of steep precipices, until, crossing a pass, we saw Chinishk lying on the opposite hillside. We entered the little town, with a population of about four thousand inhabitants, built among huge boulders, and finally emerged above it at a spot where there was a gigantic *chinar*, the "arbre sec" of the Middle Ages, so often mentioned in poems, such as the "Roman du comte de Poitiers,"† which runs—

"Se l'Amiraus ne rent Noiron
Mon oncle, qu'il tient en prison.
Jà n'i remanra tor de marbre
Que n'abace jusc'áu Sech-Arbre."

The cave lay in the limestone crags above, and after reaching its

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* Agha Khan is well known as the descendant of the "Old Man of the Mountains." Cf. Yule's 'Marco Polo,' Cordier's 'Odoricus,' etc.

† P. 54, verses 1283-86.

THE LUT.

[To face p. 155.

entrance we doffed boots and hats, and descended by some slippery stones for about 20 or 30 feet: we then reached a lateral passage, which was almost blocked by a rough box containing human bones. Crawling past this, the *crux* came in the shape of a very small hole, which, personally, I negotiated with difficulty. Beyond it the cave opened out, and we came to a tank, the presence of which clearly indicated that the cave was once inhabited. There was then a series of descents, with skeletons in a perfect state of preservation at each corner, and the gallery was said to run for miles; but our curiosity was exhausted, and we were glad to reach the open air once again, the atmosphere having been most oppressive. The tiny deformed man who was the guardian of what he termed "the shrine," told us that the skeletons were the mortal remains of a band of pilgrims, who, hearing that the *Imám* Reza had been poisoned, renounced the joys of this world and took up their abode as hermits in the bowels of the earth; their home struck me as being partly natural and partly artificial. Turning our backs on a most interesting corner of unexplored Persia, we descended the stony valley on to the open plain, and late in the day reached Mukhtarán, which lies on the Neh-Khusp road, and is a great centre for camel-breeding. Continuing our march, we next crossed a much lower range of hills, the climate growing proportionately warmer, and at the hamlet of Sibcha found that we had struck the main caravan route which, running from Neh to Khusp, crosses into Nimbuluk by the Khabísi pass, after which it reaches Dasht-i-Piáz and Gunabad. As there are four parallel routes, I inquired why this one was preferred, and was informed that the climate was milder and the grazing better, while the hill country was avoided as far as Nimbuluk.

A still lower range with a scarcely perceptible watershed lay before us, and, crossing it, we marched to Basirán, which, with an elevation of 4800 feet, is situated on the edge of the Lut. From here we rode in a south-westerly direction, through a series of low black ranges of exactly the same character as the hills on the north of this great desert when entered from Tun, and at 11 miles we reached Kala Zarri, or "Golden Fort," also known as the Kala Gabr,* or "Parsis Fort." This small square structure, built in the same manner as that at Káin, with an exterior measurement of 60 feet, and with walls 20 feet in height, was evidently designed to guard the spring of water, round which were clustered the smelting-works. Nowadays a little smelting is carried on with the most delightfully primitive appliances, copper being extracted mainly from slag: the annual

* *Gabr* originally meant "a man," whence Gabriel, the "man of God": cf. Latin *vir*, and Welsh *gwr*. It now signifies "an infidel," and is the Giaour of the Crusaders. In Persia it is especially used to designate a Parsi (cf. *Guebre*), and in Baluchistan a *Gaur* is a Hindu.

output is said to be 6000 lbs., but this must be discounted. Two miles to the south, on the skirt of the last range shutting off the flat immense Lut, the mines are dug, either in the form of deep cuttings or of shafts connected by galleries: one of the shafts measured 70 feet in depth, but we could not visit them. On the other hand, we found the cuttings easy of access, and knocked off specimens of the various ores. I was much impressed by the dimensions of these mines, which must have been worked for hundreds of years, considering the rude appliances of the day, and bitter was my regret that I could find out nothing about the miners, who were probably pre-Mohamedan, none of the Arab travellers mentioning Kala Zarri.

Continuing our journey with the conspicuous conical peak of Shah Kuh to the south, which must be a magnificent landmark for caravans traversing the heart of the desert from Khabis, we recrossed a range, and marched down into the valley, where, at the junction of nine roads, the important town of Neh * is situated. A glance at most maps will show that no routes whatever are shown running south from this centre, and yet this is Persia's great eastern artery of commerce, the caravans from Bandar Abbás passing to the west of Rigán, and proceeding from the desert stage of Gurg to Neh either direct or, if in need of supplies, by the somewhat hilly route *viâ* Nasratabád.

Upon approaching the small town, which has a population of five thousand inhabitants, the first object to catch the eye is the fort, apparently an exact counterpart of the one at Tabas, and next the attention is arrested by seeing fifty windmills in a row. These ingenious contrivances consist of two walls built parallel in a north-easterly direction, the prevailing wind blowing from that quarter; they are almost closed on this side, and are wide open in rear. Sails of rush-work are moved by the wind, and in their turn cause the upper mill-stone, which is fastened to a pole, to rotate. A few of these windmills may be seen in Sistán, and, in fact, all over Eastern Persia, which may perhaps be the home of the windmills. At any rate, they are mentioned by Masudi and Ibn Haukal as having been seen in Sistán in the tenth century of our era, when they were unknown in Europe.

Three miles to the east is a hill fort termed Kala-i-Shah-Duzd.† This was evidently ancient Neh, and was immensely strong, the only track running up the steep hill being guarded by *sangars* and a bastioned wall, similar to that of Káin. The gateway consisted of a

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* Cf. Ἐντεῦθεν Ἀναύων χώρα τῆς Ἀρείας, ἐν ᾗ πόλις μεγίστη Φρὰ καὶ Βὶς πόλις καὶ Νίη πόλις (Isidoros of Charax, 16).

† The legend runs that Shah Duzd, who is apparently connected with the Kuk or Kok of Kuh-i-Khoja, forced Zal to pay him tribute, until Rustam reached manhood, when he challenged the oppressor. A wrestling match was agreed upon, and as neither of them gained any advantage after several rounds, a truce was made to allow the thirsty heroes to quench their thirst. Rustam drank sparingly, and so easily vanquished his rival, who drank his fill, and thus sealed his own doom.

square keep with the narrow entrance underneath, while the side of the hill, rising 600 feet above the plain, was covered with the remains of thousands of houses, and I felt that I had seen nothing on so large a scale in Eastern Persia, the houses being crowded over a space of three or four acres. As ever, the tanks were empty. Neh is also said to possess mines in the hills, but our chief recollection of these latter is that from their crest some of Tate's points were clearly visible, and that, after being six months out of sight of them, we had the great pleasure of checking our work and finding it accurate.

From Neh to Bandán we found the heat distinctly trying, although we were at the end of October. At Aliabád, the second stage, there was a direct desert road to Sistán, from which an immense quantity of wheat is exported, although Neh grows quite enough for its own consumption, but it has to supply all the through caravans. We finally reached Sistán, which we found as dry as we had left it waterlogged, so that we were able to follow the direct route, known as Surkh Gazi, halting at Nasrabád, which was the camping-ground of Nádir Shah, upon his arrival in Sistán.

Here it may not be out of place to state briefly what measures have been taken for the protection and encouragement of British trade in Eastern Persia. It was a necessity for me to keep in touch both with India and Tehrán, but as the Persian post only runs a weekly service as far as Birjand, the Government of India commissioned me to organize a service which bridged over the gap between the British frontier and Birjand. To keep this service efficient and to make it of use, two Indian hospital assistants, who are eminently *personae gratae* in Persia, were stationed at Birjand and in Sistán, and Major Benn of the Indian Political Department now occupies a fine consulate in Sistán, and efficiently protects British interests, without which trade would have languished. Using this service, a letter reaches Birjand from India in less than a month, and Meshed in five weeks,* whereas by Persian post *viâ* Tehrán and Bushire, two months is nothing extraordinary. It remains for the tea-planters to take advantage of a route by which the sea is avoided, which they are beginning to do, and, as the indigo used in Persia is grown in Sind, both of these staple exports should profit by the new route, while in a lesser degree there will be a demand for many sorts of British goods.†

When it is considered that Sistán has a population of less than 100,000 inhabitants, all at a low level of civilization, it is obvious that the local trade will be small, and yet the district tapped is extensive, and a gradual development is certain, not only in Eastern Persia, but in the *Garmsil* of Afghanistán and in both British and Persian

* This rate has since been improved upon.

† A Quetta firm has cleared Rs.10,000 in the year 1899–1900, which for a pioneer venture is excellent.

Baluchistán. As to the through trade with Central Asia *viâ* Meshed, the Government of India has aided merchants by the remission of all customs and dues, and by granting a rebate on the terribly expensive Quetta railway for all goods intended for export.

To resume, between Sistán and Narmáshir there lies a corner of the Lut, about 200 miles in width, conveniently bisected by the village of Nasratabád. Retracing our steps to Varmál and Hauzdár, we struck south-west across the Palang Kuh, reaching the hills at 21 miles from the stage of Chah Lashkarán. However, there was no water until, after ascending a wide *nala* for a considerable distance, and accomplishing a march of 37 miles, we found our camp pitched near the bitter spring of Turshâb. The advance camels having taken twenty hours over the march, a halt was imperative, after which we rose across the high range and descended on to the plain of Garágha—the Kilagh Ab of the Sistán mission—where there is very rich grazing and a *kanat* of fair water. Were there security, a village would speedily spring up once again. This plain is famous as having been Rustam's favourite hunting-ground, and it was here that Bahman, the Darius Longimanus of the Greeks, when sent on an embassy, tried to murder the hero by starting an avalanche. This, however, failed, Rustam diverting the stones with his foot, as recounted in the *Shah Náma*.

The next stage to Nasratabád lay across the Malusán range, where there are the shafts of disused copper-mines known as Chehel Kura, or "Forty Furnaces," and also a shrine termed Sabz-i-Pushán. Nasratabád is the name of a fort built by the Vakil-ul-Mulk, Governor-General of Kermán, shortly before the passage of the Sistán mission, on the site of Isfe, which is still called Ispi or Sipi by the Baluchis. It is a veritable oasis in the desert, and capable of great development, but as the garrison is irregularly paid, the fort is at the mercy of the surrounding Baluchis, who render the road unsafe. Its population consists of an entirely nominal force of forty camelry and some thirty families of cultivators. There are, also, some Baluch nomads dotted about the valley.

Barring access to the south, a high range runs across the road for perhaps 30 or 40 miles, with only one pass. In my opinion, this conformation of the mountains proves that it was the route by which Krateros joined Alexander the Great after his arrival in Kermán, travelling down the Helmand to Sistán, and thence making for Fahraj in Narmáshir, which has been—erroneously, I would maintain—identified with the Pura of Arrian. From Narmáshir there is a low easy pass, the Daháng-i-Abbas Ali, leading to Rudbár, where Nearchos also rejoined his master, as mentioned above.*

* It is impossible to discuss this question here fully, but in my forthcoming work, 'Ten Thousand Miles in Persia,' which is being published by Mr. John Murray, all the subjects touched on in this paper will be dealt with at length.

PILLAR OF NÁDIR IN THE LUT.

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Continuing our journey, we were obliged to march in one body, as there was a band of Baluchis on the road, and, rising towards the range, we entered a valley which gradually narrowed until we reached what is known as the Darwáza-i-Nádir, or the "Gate of Nádir." A ridge runs right across the valley, on which towers of masonry were built, while an apparently artificial cutting, lined with masonry, bore traces of having been fitted with a door. I will quote a passage from the published manuscript of a 'History of the Seljuks of Kermán,' which throws some light on this. Referring to Malik Kaward, who was put to death in A.H. 466 (1073), it runs as follows:—

"On the Sistán road, in the valley of Kaward, at four farsakhs from Isfa, a *darband*, i.e. a door closing the road, was erected. The door was of iron, and a guard was posted there." It is thus clear that Nádir Shah has usurped the credit of the great Seljuk prince.

The pass known as the Gudar-i-Surkhwak is crossed a mile above, the track being only wide enough for single file, and Krateros' elephants must have experienced difficulties, although there is just room for them. The descent was rather steep, but we enjoyed the view across the yellow Lut, while in the far distance we could see the well-known Kuh-i-Bazman. We camped during the heat of the day at Robát, a ruined caravanserai situated at the exit from the hills, where there is no water, and reached Gurg the following morning at sunrise, after a march of 35 miles from Nasratabád.

Gurg, or "Wolf," is considered to be one of the most appalling stages in the Lut, the water being almost undrinkable even for animals, and the heat in summer so great that even the Baluchis frequently die from it. When it is recollected that there is no water in any direction for 30 miles, while a strong wind will obliterate the track in a few minutes, I think that the disadvantages of Gurg will be realized. In the afternoon we continued the march, the track crossing the bitter Gurg river which has, quite erroneously, been regarded as the lower reach of the Rud-i-Máhi, and, crossing the level desert hour after hour, at 21 miles we passed what is known as the Mil-i-Nádiri. Only some 15 feet of the burnt-brick column are standing, but 20 miles before reaching Fahraj we passed a second column in an almost perfect state of preservation, although the loss of many bricks round the base will soon bring it down. Its dimensions are—height, 55 feet; circumference, 43 feet, and slightly tapering; thickness of wall, three feet; and there is a staircase to the summit.* As the subject is of interest, I will again quote from the Seljuk history. "Every three hundred paces a pillar twice the height of a man was built by Malik Kaward, so that by night from each pillar a second could be seen, in order that no one should lose his way. At the top of the valley, where the pillars began, a caravanserai, a tank, and a bath were constructed; and two

* These measurements are taken from Sir F. Goldsmid's 'Eastern Persia.'

minars were built between Gurg and Fahraj, one forty *gaz* * in height and the other twenty-five *gaz*, and under each *minar* a caravanserai and a tank." None of the pillars are now standing, but many of their bases are still visible, while the caravanserai is that of Robát, where we halted between Nasratabád and Gurg.

After marches exceeding 30 miles, we were delighted to see the village of Fahraj, which was, it is stated, held by the Afghans well into this century, and is mentioned by Edrisi. It has a population of a thousand inhabitants, and supplies the cultivators for Nasratabád; it also boasts of one of the few date-groves of Narmáshir. Lying on the right bank of a sluggish river, and possessing excellent camel-grazing and sweet water, it would have afforded us an enjoyable rest, but as information reached me that Captain Napier, of the Oxfordshire Light Infantry, had passed through Bam, and would, in consequence, be awaiting me at Kermán, we marched on, joining a twice-trodden route at the bridge of Azizabád, and, after a fast journey, entered Kermán on December 2.

My first care after settling down was to organize and despatch a trial caravan to Quetta, Captain Webb Ware having kindly agreed to assist me in the matter. The exquisite carpets, the finest in the world, had never before been exported to India, and I felt that they should form the bulk of the venture; so for some weeks the merchant who agreed to embark on the enterprise (which I partly financed), brought up bales of carpets, all of which were carefully examined by me before being passed. Two Baluch levies came across to act as guard, and with samples of Yezd silks, saffron, homespun, and pistachio, the little caravan, the pioneer of greater things, started. Fortune smiled on it, as His Excellency the Viceroy happened to visit Quetta at the period of its arrival, and the purchases he made were so considerable and drew such attention to the caravan that the carpets were all sold at a handsome profit. In 1900 the second and much more important caravan was equally successful, and I now consider the trade established, to the mutual benefit of Indo-Persian relations. Looking ahead, I venture to forecast that this trade route will, if fostered, be increasing in importance when the other is a thing of the past.

At the beginning of 1900 I spent some weeks at Yezd, enjoying the hospitality of Mr. Fothergill, of the Imperial Bank of Persia, and was enabled to study the history of the "City of the Sands."

The foundation of Yezd is universally ascribed to Alexander the Great, who built a fort to serve as a prison for his captors, these unfortunates being confined in a deep well. In reference to this, Háfiz says, "I was afraid of Alexander's prison (sc. Yezd), and prepared to start for the country of Suliman (sc. Fárs)." Apparently the city was

* A *gaz* is approximately equivalent to a metre.

YEZD.

[To face p. 160.

known by some other appellation, as the name of Yezd was given it by Yezdigird, the father of Bahrám Gur, who reigned during the fifth century. After the Mohamedan conquest, the district became the headquarters of the followers of the old religion, who still number six thousand.

In the thirteenth century, Marco Polo speaks well of Yasdi, and not long afterwards the Friar Odoricus visits Geth, as he terms it; but the best description of all is given by Josafa Barbaro in the fifteenth century. He says, "We came to Jex, a towne of artificers, as makers of sylkes, fustians, chamletts, and other like . . . they all arr wevers and makers of divers kindes of sylkes which came from Straua,* from Azzi, and from the cities towards Zagatai; towards the sea of Bachu,† the best whereof come from Jex, w^{ch}, wth their workes, do afterwards furnishe a great parte of India, Persia, Zagatai, Cim and Macim ‡ parte of Catay, of Bursia § and of Turchie; wherefore lett him that woll bie good silkes of Soria,‖ faire and well wrought, take of these." ¶

Approached from the east in a sandstorm, the effect is extremely weird. Rolling sand-dunes are passed through, and nothing can be seen of the city, except a forest of wind-towers, dominated by two of the lofty gateways with *minars* which are peculiar to Yezd, the whole giving a marvellous sense of unreality. Travellers generally point to the fact that the sand touches the walls of Yezd as a proof that it is slowly being engulfed. This is, however, not the case, as it is the town that is encroaching on the dunes, which are steadily being enclosed and cultivated.

During my stay, after a considerable amount of inquiry, two manuscript histories were produced, one of which, known as the Tárikh-i-Jadid, or 'Modern History,' and written some six hundred years ago, gives a good account of the chief buildings. The Yezd of that date lay, in part, a little to the north-west of the present city, and its oldest building is the Masjid-i-Jáma. This was originally constructed in A.H. 513 (1119), by Sultan Ala-u-Dola, Gurshásib, of the Kanjar tribe. It is related that Yezd was given to him, at his request, by Malik Shah, as a place to pray in, and that its designation of Dár-ul-Ibada, or "Place of Prayer," dates from this period. The mosque, which the son-in-law of the governor showed us over, is entered through one of the high gateways referred to above by two doors which are magnificent specimens of wood carving, but will in a few years disappear, no attempt being made to keep them in repair. The mosque itself lies at right

* Astrabad.

† The sea of Bachu or Baku is the Caspian.

‡ *I.e.* Chin and Machin, or China.

§ Bursia is apparently Basra.

‖ Probably Syria.

¶ 'Travels of Early Venetians,' p. 73.

angles to the gateway. Its great dome is nearly bare, but the interior is still perfect, and the mosaic work presents a fine appearance. On the *Mehráb** the date A.H. 877 (1472) is worked into the mosaic, while it also appears on a tablet under the gateway, evidently of the period of the last restoration. We saw the ruins of a *Garm Khana*, or "Hot House," where prayers are said during the winter, which were said to cover the ancient site of a fire-temple; this fact the Parsis corroborated.

Close to the fort, which dates from A.H. 532 (1137), but is of little interest, is a building, called the Vukt-i-Saat, of which only a dilapidated dome with a large hole is left. It is, however, ornamented with Kufic characters in dark blue, light green, and brown, which, on the white, produce a most harmonious and artistic effect. This is all that remains of an observatory, a college, and a clepsydra,† which must have been of great splendour at the time of its completion in A.H. 725 (1324).

Yezd was evidently at its zenith just about this period, as the shrine of Taki-u-Din, Dáda Mohamed, dates from the following year, A.H. 726

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* The niche, which indicates to the worshipper the direction of Mecca, is termed a *mehráb*.

† The description of this wonderful piece of mechanism runs as follows:—

"Opposite the entrance of the *madresa* are two columns, on one of which there is a copper bird, and this bird always looks towards the sun and swings round. On the other column is a flag that appears five times a day, when the drum should be beaten. On the *minár*, in the middle of the observatory, was a wooden wheel painted. It was divided into 360 divisions; each division had degrees, showing every day that the sun rises, in letters representing numbers. On the four corners of the wheel four circles appeared. On each circle were thirty divisions, and the name of the month was written in Turki, Rumi, Arabic, and Jaláli (*i.e.* Persian of the new era). Every day that passes has one division. From two little windows above the wheel two bronze birds appear, and throw bronze dice into a bowl that is placed below the birds. Then the wheel moves, and of twelve white boards that show the twelve hours one falls, and a black board comes into its place, and at the five times (sc. of prayer), when the die falls, the drum inside the observatory is struck, and the flag appears on the *minar*. The circle is drawn to the top of the wheel, and thirty white circles are placed on it. Every day of the month one of the circles will be black, and on these circles the whole of that month is written. And on another side, opposite the clock, twelve other boards are placed, and at night, when one hour passes, one lamp of the twelve that are placed appears again. In the middle of this wheel there is a zone or zodiac, on which the names of the forty-seven stages of the zone are written. Also, above the circle of the zodiac, the names of the five great planets, Zohal, Mushtári, Otárid, Marikh, and Zohre, were written, and the description of every day and of every star (*i.e.* whether auspicious or the reverse).

"Inside the observatory was a cistern, twice the height of a man, made of copper. Every day it was filled with water, and copper dishes were fastened by a chain on the surface of the water. And below that cistern an astrolobe of bronze is constructed, and from one side of the machine the water comes out from the hole, and as the water of the cistern decreases the dishes sink, and the whole of the works are moved by that water; and small bowls, hung up like trays, show the minutes, and every minute a hammer is struck on them, and gives forth a sound, and low down in the observatory is a wooden window, with a wooden bolt, and it is from this that the sound comes out."

(1325). Lying outside the present city, it contains a fresco representing Ali, his two sons, and his two favourite servants, Suliman Fársi and Kamber Ali—the latter a black slave—and is commonly known as the shrine of *Sheikh* Dád.

The Meidan-i-Mir-Chakmák is the square of Yezd, containing the second high gateway and a well-preserved mosque, Mir Chakmák having been ruler of Yezd in the ninth century of the *Hijra*, and it was he who repaired the great mosque. In this square is an octagonal tile-covered erection some nine feet in height, with a circumference of perhaps 20 feet. It is termed a *kalak*, which usually signifies a clay bowl used as a brazier, and during the month of Moharram it is a centre for the reading of the Passion play, a fire being lighted when necessary, and lamps burning in the niches. It is interesting to know that this *kalak*, so far as Mohamedans are concerned, is peculiar to the Yezd district and Kashán, and as the Parsis have these *kalak* in their shrines, it appears that they have been locally adopted by the Mohamedans; at Kermán they are termed *magribi*, or "west," evidently in imitation of the Mohamedan *kibla*.

But enough of ancient Yezd; let us turn to the city of to-day. Still retaining a considerable manufacture of silk, Yezd is even more important as a commercial emporium, most of the goods imported for Khorasán changing hands in its somewhat mean *bazúrs*, which are, however, supplemented by large caravanserais, while it is also the centre of the henna trade, and, in a lesser degree, of the export of opium. Only growing at most three months' supply of grain in the district, Yezd, thanks to the commercial activity of its inhabitants, and in spite of the chronic insecurity of the roads, has a large class of wealthy merchants. Sad to say, however, the blighting curse of opium-smoking is as much on the increase here as elsewhere in Persia, with every likelihood of ruining the whole nation, for the vice spreads by leaps and bounds, until smoking is carried on quite openly.

The Parsis, who undoubtedly surpass their fellow-countrymen in the qualities of enterprise and hard work, are now beginning to advance along the path of progress, although their *dasturs*, or priests, are opponents of all enlightenment. The climate of Bombay being unhealthy for the Yezd Parsi, who sees the physical degeneration of his countrymen, he generally returns to his home, even although he may not ride an ass inside the town. I may note that Yezd has a hot and trying summer, but, owing to its great dryness, the climate is healthy, while the winter months are bracing.

The Imperial Bank of Persia is now firmly established; while the unwearying devotion of Dr. White of the Church Missionary Society and staff, and the fair dealing of our countrymen, have changed the townspeople from being fanatical opponents of Europeans into adopting a friendly attitude, the recently constructed hospital being daily thronged.

My visit in 1900 was a striking proof of this, as the three leading *mullas*, who between them hold Yezd in the hollow of their hands, all visited me, and, as the ice has once been broken and friendly intercourse established on a sure footing, I am confident that Yezd will answer to the friendly pressure that is being exerted, and benefit thereby, if slowly yet surely.

To return to my journeys, to the south-west of Kermán is an unexplored triangle of upland country lying between the Báft and Sirján roads which I had been anxious to explore for many years; while, having read that an ancient capital of the province was to be found in Sirján, my eagerness was naturally accentuated. It was not until April, 1900, that the longed-for opportunity presented itself, and, leaving Kermán, we marched across the plain to Jupár. Our second stage was Bahramjird, the meeting-place between Jalál-u-Din of Khiva, who strove to stem the Moghul invasion, and the disloyal Borak Hájib; while, a few years later, it was undoubtedly a stage on the route of the illustrious Marco Polo, who was then bound for Camadi * and Hormuz.

From Bahrámjird we swung due west to Nagar, where there are interesting ruins which at one period were used as a mosque. Only the walls are standing, which show clear signs of having been built at two periods; to the later, a brick *minar* with a blue band of Kufic inscription must be assigned. The *mehrab*, until quite recently, bore an inscription dated A.H. 615 (1218), and as it is set towards Jerusalem, we may feel confident that this was originally a Christian place of worship, there having been, as is well known, a Nestorian bishop of Kermán.†

At Nagar we had struck the main Bandar Abbás Kermán road, which we decided to follow as far as Báft, and, after crossing the level plain for some miles, we rose across the Zárchi pass, which was aflame with the yellow flowers of a bush termed *durmun*. A narrow valley separated us from the frowning range of Bid Khán, across which is a pass, termed Soghurk, explored by the indefatigable *Khán Bahádur*. Crossing and recrossing the river, which, after watering Mashiz, is lost to the north of Báft, we ascended to the pass which bears the ominous name of Kafanu, or "Shroud;" but in April the snow had melted away, and the gradients are so easy that cavalry could gallop across it. Indeed, although its altitude is 9300 feet,‡ it could, without much difficulty, be kept open all the year round. On the southern slope of the pass is the district of Kiskán, the summer quarters of the Lak, one of the most ancient Persian tribes, while on the bare open plain lies the large village of Báft.

* Camadi is the Komádin of the history of Seljuks.

† The Rev. C. Stileman, of the Church Missionary Society, was the first to identify these ruins.

‡ My aneroids were unreliable during this tour.

We had now reached the 29th parallel of latitude, which I had decided was to be my southern limit, and once again we marched due west into unexplored country. During the second stage from Báft we crossed the watershed of the Halil Rud,* the most important river in the province, and then descended into the basin draining into the great *kavir* of Persia. As is so often the case, we filled in this blank on the map with numerous villages and hamlets, before reaching Saiidabád,† the capital of Sirján.

A few miles to the east we visited the Kala-i-Sang, or "Stone Fort," which is also known as Kala-i-Beiza, or "Fort Egg." It rises in glorious whiteness some 300 feet above the plain, and, as its name implies, is egg-shaped. Approached from the north, this remarkable limestone crag is surrounded at some 50 yards from its base by a low mud-brick wall, which bore traces of having been rebuilt on older foundations. Inside this we found a beautiful stone pulpit, some five feet high, on one side of which were four perfect and one obliterated row of *Naskh* ‡ inscription, which ran as follows:—"A sovereign, great, just, glorious and victorious, Sultan Ahmad." The date was A.H. 789 (1387), and Sultan Ahmad, better known as Imad-u-Din, was a member of the Muzaffar dynasty. He ruled Kermán for many years, and was, with the other members of the family, put to death by Timur in A.H. 796 (1393). Moving round to the south-west corner, where, as also at the north-east angle, there is a high traverse wall, we entered the fort by its only approach. On the right-hand side, just below a brick dam, we read with some difficulty a second inscription, or rather a portion of it: "In this blissful abode *Amir Azam* Husein-ibn-Ali constructed the *hammám*." The date was anything between A.H. 410 (1019) and A.H. 420 (1029), the third cypher being illegible. The individual commemorated was probably the Deilamite Governor. The crag runs from north-east to south-west, and is some 400 yards in length, and perhaps half as much in width, the north-east end being the highest. There are practically no remains on the summit, everything having been washed away, but facing the pulpit is a fine grotto known as the "King's Seat," where the name of Mohamed Shah is finely chiselled. Below is a second grotto, known as the *Anderun*, or "Women's Quarters." No antiquities were forthcoming, and descending we examined the southern side of the city, where there are two walls, one 40 yards and the other 200 yards from the base of the "Akropolis."

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* This name was given by the Arabs, and is perhaps a corruption of Hari Rud, the river which forms the eastern boundary of Persia for so many miles. Ammianus Marcellinus (xxiii. 6. 48) mentions the Sagareus, the Saganis, and the Hydriacus as the rivers of Kerman, and as the Halil is by far the most important, it must be one of them.

† The universal spelling of Saidabád is incorrect.

‡ *Naskh* is copperplate Arabic.

This, then, was an ancient capital of Kermán, in regard to which I cannot do better than quote from Afzal Kermáni, who writes in A.D. 1188; "Among the divisions of Kermán is Sirján, the ancient capital of Bardsir, a fine fertile district, . . . and in it are many old graves; and travellers and Sufis term it Lesser Syria. And there is a great fort reaching to the clouds. During the reign of Arslán Shah * it was repaired and again destroyed. To-day it is occupied." So far as I could gather, the Kala-i-Sang was captured by Timur's forces, and when the small remnant of the population was again collected, Shahr Biumidi, or "City of Despair," as it was appropriately termed, was founded. During the Afghan invasion the Kala-i-Sang was again occupied, but was captured, and, the Shahr-i-Biumidi having been destroyed, a certain Mírza Saiíd founded the present capital, which has a population of perhaps 10,000 inhabitants, close to the Shahr-i-Biumidi. The *kalantar* informed me that he was married to a descendant of Mírza Saiíd, who was evidently the local governor. The plain of Sirján lies at an elevation of 5300 feet, and is in every way richer and more fertile than Kermán; so that it is evident that it was only abandoned as being too exposed for a capital.†

It was the second week in May when we left Saiidabád and shaped our course for a flat-topped hill known as Takht-i-Tanbur,‡ or "Throne of Timur," the route we followed lying to the east of the one shown on the map. Halting at Amirabád, I was visited by the brother of the chief of the Karai tribe, or rather of its Kermán branch, under whose guidance we entered the hills, and, striking a small river at Sukta Chál, a hamlet of *Seiids*, ascended to the headquarters of the tribe at Tangru, probably a contraction of Tang-i-Rud,§ where some two hundred black tents were pitched. From this stage we again followed the river to the village of Takkia, where the chief of the Buchakchi visited me. He is quite a Persian Robin Hood, and a few years previously had occupied Sirján for a considerable period, pretending that he had been appointed governor, and writing imaginary telegrams whenever he was getting the worst of it. Continuing the journey, a mile above Takkia we passed a remarkable spring termed

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* Arslán Shah was the sixth Seljuk ruler of Kermán, who reigned from A.H. 495 to A.H. 537 (1101 to 1142).

† In the *Journal of the Royal Asiatic Society* of April, 1901, Mr. Guy le Strange, relying on the itineraries of the Arab travellers, considers that the capital was elsewhere; but these worthies are most inaccurate as regards distances: at the same time, Ibn Haukal rightly mentions that Sirjan is situated on the confines of the uplands and lowlands.

‡ Cf. "We'll lead you to the stately tent of war,
Where you shall hear the Scythian *Tamburlaine*
Threatening the world with high astounding terms."
MARLOWE.

§ Or "River Defile."

BRONZE AXE-HEAD FROM KHINAMÁN (*right*).
(Compared with axe-head found in Armenia.)

[*To face* p. 167.

Abbád, where the water bubbled up with considerable noise, but at a normal temperature. It is evidently the spring about which the late Sir Oliver St. John was told of as "bubbling up to a great height with a noise that is audible a *farsakh* off." *

The mountains were thickly covered with scrub and the stunted tree from which gum is extracted, and we crossed the pass known as Seh Gudári † at an elevation of some 9000 feet. We thence descended into a steep valley crowded with willows, and, skirting the Chehel Tan range, camped on the mountain slope at a village that is termed Kala-i-Sang. This was our last cold night, a short march bringing us to Máshiz, which, in the middle of the nineteenth century, was occupied by Agha Khán for some months. At this point I struck my first journey in Persia, and two days later Kermán was again reached after a most interesting tour.

In July, 1900, I climbed the Kuh-i-Shah, which I had ascended in 1895, and Kuh-i-Hezár was next scaled. It also rises to nearly 14,000 feet, and in shape is a gigantic "Hog's Back," the climb not being difficult. The term *Hezár*, or "Thousand," is said to refer to the number of its plants. In any case, a botanist could not do better than start work in this range, where the number and variety of scented bushes was extraordinary. During this tour the little district of Givar, to the east of Sardu, was given an existence on the map; and I returned to Kermán, having explored the whole of its highlands.

I had been told by a Khán that, while laying out a garden in Khinamán, a large number of bronze arrow-heads had been dug up, and as the district lying due west of Kermán was a blank on the map, I decided to ascertain whether or no my friend had made an interesting discovery. When I reached Khinamán, I found that some five feet below the surface hundreds of tombs had been struck. The corpses being dust, it could not be ascertained in what direction they had been laid. In each tomb was a small jar of pottery and the following articles in bronze, viz. a pair of bracelets, two pins, and four or five arrow and spear heads: there were also copper bowls. A bronze axe-head representing a fish, and two handles which apparently fitted some weapon, completed the list of what was to be seen, my host having allowed almost everything to be thrown away. Of the bowls there were three shapes, one being evidently a lamp of a primitive kind. I was also told of a cornelian,‡ a pair of silver bracelets and a lozenge-shaped earring of the same metal. Great jars full of yellow dust, probably wheat, had also been found, and well-burnt bricks. The jars I saw, and found them wider and more squat than those of to-day. The yellow dust had all been thrown away.

* 'Eastern Persia,' pp. 103, 104. † "Three Passes" is the signification.

‡ A cornelian with the names of the twelve *imam* engraved on it is often placed in the mouth of a dead man.

On an adjacent cliff we saw the ruins of a fine old stone fort, but there were no traditions except that Aza Mahán, the founder of Mahán, or Mahún, had built a village in the district, which had sent a levy of seven warriors mounted on bulls to aid Yezdigird, the last monarch of the house of Sassán. Close by were other tombs, in which the corpses had not quite become dust; they contained jars of a different shape and fragments of iron, probably arrow-heads, so that Khinamán is rich indeed in antiquities.

In November the drum of departure was again beaten, and by the end of the month Jiruft was reached, which I thoroughly explored while waiting for Lieut. Crookshank, R.E. I discovered several other ruined cities besides Marco Polo's Camadi, all of which had apparently been destroyed by floods. In fact, so dense had the population been that for miles a line of towns and villages had existed almost touching one another.

At Bágh-i-Bábu, a few miles south of Camadi, an alabaster vase was brought for sale which is considered by the British Museum authorities to be an unguent vase of Greek manufacture dating from the fourth century B.C. This discovery is, I would urge, of the greatest importance, as Edrisi mentions the city of Hormuz-ul-Malik—it was a ruin in his day—as having been the capital of the province before Sirján. Here, then, at last we may locate the "Karmana omnium mater" of Ammianus Marcellinus, and it was surely here also that Alexander the Great was resting when he received the welcome visit of way-worn Nearchos.

Being joined by Lieut. Crookshank, we slowly marched towards Gulashkird,* which was certainly on Marco's route, and then swung west to explore another Kuh-i-Shah, which has the same legends as its namesake near Kermán. At Dolatabád, in Urzu, the objects of my tour having been accomplished, I sent back my Persian secretary to Kermán, and marched rapidly down to Bandar Abbás. A good deal of rain had fallen, and there was doubt as to whether the famous or infamous defile known as Tang-i-Zindán, or "Prison Defile," would not be closed. For some 20 miles the track runs up and down river-beds, and many caravans have been swept away by irresistible floods. Fortune, however, smiled on us, as we were in the *tang* a day after a spate, and safely emerged on to the plain, quaintly termed Formosa by Marco Polo. The contrast between the population of this coast strip and that of the highlands was most noticeable, and the Khan Bahádur said that, but for the palm groves, everything reminded him of the Panjáb, from the creaking water-wheels to the dress or undress of the peasantry.

At Bandar Abbás I stayed with Captain Hunt, who had been

* Edrisi gives Kanat-ul-Sham, Maun, and Walasgird as the three stages. Maun is Moghun, and Walasgird is Gulashkird.

BANDAR ABBÁS.

[*To face p.* 168.

commissioned to found a Vice-Consulate, and two days later I started for South Africa. At Karachi, where I parted with much regret from the indispensable Asghar Ali, a coolie ship was just starting for Mombasa, and by great good fortune I caught a Mauritius steamer at the lovely Seychelles, where I enjoyed the hospitality of Mr. Harold Baty. At Mauritius Mr. Ireland entertained me, and early in March I finally reached South Africa. There I twice crossed the Karroo * and imagined myself back in Persia, while the ruins in Rhodesia struck me as akin to the *gorbasta* of Baluchistan, which, indeed, is not at all impossible.

To conclude, until wounded I had the great honour of serving in command of Welsh Yeomanry under Lord Methuen.

Before the reading of the paper, the PRESIDENT said: Many of you who are present this evening will remember the very interesting paper Major Sykes read to us four years ago. Since that time he has done a prodigious amount of valuable geographical and political work in Persia, and now we have the great pleasure of welcoming him here again. I call upon Major Sykes to give us his paper.

After the reading of the paper, the following discussion took place:—

Sir THOMAS HOLDICH: Some years ago, when we first heard of Major Sykes's explorations in a difficult and dangerous country to the east of the Caspian, I think very few of us anticipated what the conclusion of a career would be which led him to the Consulate at Kerman; for it is no figure of speech to say that Major Sykes *made* the Consulate at Kerman, and that by his energy and his capacity there, he has placed British prestige on a pedestal such as it never occupied before. If you look at the position of Kerman on the map, lying as it does athwart one great route from north to south, and marking another from India to Western Persia, I think you will agree with me that the strength or weakness of British influence in that quarter cannot fail to affect all relations, whether political or commercial or strategical, that at present lie between India and Persia; nor can it in the future fail to be an important factor in the settlement of the final question of supremacy in Persia whenever that political nut comes to be cracked. I really think that amongst the many developments which have taken place on the Indian borderland of late years, the foundation of the Kerman Consulate is one of the most important. I can personally testify, as nobody else can, to the extraordinary influence which Major Sykes exercised over the people with whom he had to deal in that quarter. It was an influence gained by just those same qualities of ready adaptability to the country and the people with whom he had to do, of keen insight and participation with their sports and pastimes,—the same qualities which afterwards fitted him so well to become a distinguished leader of yeomanry in the fields of South Africa under one of the best of our fighting generals. But it is chiefly to the geographical side of his work I should like to direct your

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* Rudyard Kipling's lines apply to Persia just as well as to the Karro. They run—

> "Royal the pageant closes,
> Lit by the last of the sun—
> Opal and ash-of-roses,
> Cinnamon, umber, and dun."

attention. Major Sykes has not mentioned that he was assisted, at any rate in later years, by one of the staff of native assistants in the Survey of India, one Asgar Ali, a patient, painstaking, hardworking topographer, who, under Major Sykes's direction, has succeeded in securing a very fine acquisition of fresh geography in that country. Now, it is exactly to this particular combination of good and intelligent leadership and sound professional assistance that we have most to hope for in future geographical fields—and those fields are very large. Asgar Ali only represents one where dozens like him are wanted. We do not want one man or two men, or a few men in driblets, but we want companies of topographers of the same sort, in the same way that Russia has them, or that America has them, or, in short, as most civilized countries possess them, except our own country, England. I should like, if I could, personally to be able to testify to the value of the work which has been done, but unfortunately I have not had the opportunity of traversing so much of the country as Major Sykes has. However, I feel sure that a great future lies before us in that direction, and I trust that under such leadership as Major Sykes's, and with the assistance of such men as Asgar Ali, we may yet make a clean sweep of all that is unknown in those out-of-the-way districts in Southern Persia, and establish ourselves in the forefront of Persian geographers.

Mr. C. H. Read: I shall venture to say a few words on quite a different part of Major Sykes's explorations from those that have been treated by Sir Thomas Holdich. I have not had the privilege, as Sir Thomas Holdich has, of visiting Persia, but for many years past it has been a pleasure to me to study the remains of antiquity that have come from that country, and I should like to say a few words with regard to some of the objects that you have seen or may see in the tea-room, that Major Sykes has brought here this evening. First among these, and I think almost the most beautiful, are the beautiful iridescent tiles, both ancient and modern, of which he has a very good series. Now, these tiles are, I think, among the most beautiful ceramic products that the world has ever seen. That may sound a strong statement, but I think it will be borne out if the comparison is made with the best products of all the pottery manufactures of the world. To me it seems that these charming tiles—they are mostly tiles; we have seen in the slides some of the vases, but these are somewhat too fragile to carry about, as Major Sykes says—it seems to me that these tiles have a peculiar interest for us, although it may be that the genealogy of them is rather long. Here in Persia, so far as we know through the whole length of it, these beautiful pieces of pottery have been made during many centuries; from there they have been traded to the West, and they have come to what is now Turkey. There they have been adapted and adopted very largely, and they cover the mosques in Constantinople and in the provinces. Once they get to the Mediterranean the spread is very easy. The Moors carried them to Spain, and there in the fourteenth, fifteenth, and sixteenth centuries we get an analogous ware with analogous beauties to those of the original prototype. From Spain they come to Italy under the form of majolica, from Italy to Holland, and from Holland to our ordinary common English delft. That is, as I say, rather a long pedigree, but it shows us that we have to this day, in a word in common use, the word "delf," a bond which unites us with the best artistic period of Persia, and I would commend to you who love beautiful things—and I have no doubt most of you do—an examination of the older tiles (I am afraid I have a preference for the older ones) shown in the tea-room. Many of the specimens there date from the thirteenth and fourteenth centuries. There must, in fact, be much older ones, because no art sprung into completeness and beauty, such as these tiles of the thirteenth and

fourteenth century, without a long period of probation. These older ones must exist, no doubt do exist, but how are we to find them? They do not exist in the mosques; they have probably been destroyed to make room for the more modern ones. They must be looked for on the sites of the old potteries, and there they will be found, I have no doubt, as Major Sykes has already found fragments in various places. So far with regard to the pottery, which I think will share with the carpets, of which Major Sykes spoke in such high terms, and deservedly so, the credit of being one of the most artistic products of Persia. Another instance of their artistic work is seen in the bronze arrow-heads and axe-heads which Major Sykes described as having been found in a tomb by a friend of his, which he afterwards examined on the site. These objects are all bronze, and that leads us to think that they may belong to what is known as the age of bronze, by which is meant the age before iron came into use, before it was known as a metal. This may be so, and it probably is; but it must not be forgotten that when one speaks of the age of bronze, it has only a local significance: the age of bronze in Persia may be a very different period in chronology from the age of bronze in the Mediterranean. No doubt the Mediterranean, or at any rate the countries not very far from it, have a particular bearing upon some of these objects that Major Sykes has shown here this evening. In the tea-room there is an axe which is in every way a very curious object; it is a kind of double-bladed weapon with a great crest on one side and a very curious blade on the other, and in the middle a design, which, I dare say, will be a sealed book to most inexperienced eyes that look at it, but fortunately we have an axe in the British Museum more or less analogous to it, and which was found—and this is the important point—no nearer than Armenia, which is a very long way off from South Persia. This axe from Armenia, which is not very far from the home of the beginning of culture,—this axe of the Mediterranean has upon it, on the back of the axe—the side away from the blade—an ordinary figure of a lion. Now, if you bear that in mind, and look at this axe in the tea-room, I think you will see that the lion has become reduced to a mere survival of the outlines of a lion; that the blade, in place of being a useful part of the weapon, has been turned down instead of standing at right angles, and has thus become useless as a blade, and the whole thing has become the mere symbol of an axe. A warlike people who invent an axe are very careful to see that it shall serve the purpose for which it was made—to cut a skull effectually. The axe from Armenia has all these qualities; but here we come to what is merely the survival of an axe, the ceremonial form of the thing, which shows not only the distance through which the type has travelled, but also, it may be, the difference in age which lies between these two objects. The arrow-heads themselves are of the ordinary leaf-shaped form, which is certainly the most effective for an arrow-head; but there is nothing in that to give us any idea of the date. What will tell us is excavation. There is nothing to be done in a country like this except excavation. History is so entirely covered with legend and story that it is not to be relied upon. I think even the most ardent Greek scholar present would admit that the Greek stories of the early history of Persia are very little more than legend. What we want is excavation, and I think that if we could explore on certain of these selected sites, which were great cities either in mediæval times or in the times of Alexander the Great, we should make very great discoveries; but there is a reason, I am sorry to say, why we cannot do this. A few years ago—I forget how many—the French Government obtained a monopoly for the excavation of antiquities in Persia, a monopoly which forbids England or any other country from making excavations of this kind. It seems to me that it showed considerable indifference towards the

progress of knowledge on the part of those responsible, that in England we should have let an opportunity like this pass without making some kind of protest to reserve, at any rate, a district of Persia, which might have been left for the energies of our friend Major Sykes. What I hope to see is, when this monopoly comes to an end, that Major Sykes, and others like him—he will agree that there is work for more than one—will be allowed to explore sites in Kerman, and that in time by these excavations we may know something definite of the history of early Persia.

Sir HENRY HOWORTH: I should like, if I may, to add two or three words to what has just been said about my friend Major Sykes, and two or three words entirely from the point of view of its history, in regard to the extreme interest of the district which he has explored, to which I have devoted many of the years of my life. I will limit myself to a very few sentences, but there are three points which seem to me to be of particular interest. To my mind this district is the most tragical of all parts of the world in regard to its history. In a great many other countries we have huge deserts which have always been more or less huge deserts; here we know that almost every part of the country must in early times have had extremely flourishing settlements. Take that district of Sistan, the ancient Sacastene, so-called from the Sakas who once occupied it. It is now an almost empty waste, but was once very flourishing. Its history goes back a long way. It has this remarkable interest among others — that after the Sakas had conquered the larger part of the north-west of India, and had founded the great state of Sakastene, St. Thomas went to India, and he stayed with, and was entertained by the great king of the Sakas. We have within the last five-and-twenty years recovered some of the coins of this king, and that is very interesting, because they confirm the life of the saint, which was thought to be very mythical, but which in some respects is anything but mythical. And we not only recovered the coins of the king, but the coins of his father were also mentioned in this extraordinary life of Sir Thomas. That shows you how interesting it would be if, as my friend said, we could only put the spade into the ground. We have the greatest possible assurance that the ground must be teeming with most interesting objects. Now we will turn to Kerman, which Major Sykes made so long the centre of his explorations. When we speak of the Turks we think of the European Turks, but the real Turks, the civilized Turks, the Turks that did more than any other nomad race for raising Asia out of the slough of despond, were the so-called Seljuks. They founded a very famous dynasty at Kerman, and its history has just been published for the first time in the original, and I hope in the course of a few months we shall have a complete translation of it. There is one other point I wish to mention. Along that seaboard of Persia where Alexander lost so many men, there are tracts covered with splendid aromatic shrubs; that coast is dotted all over with a name derived or connected with the old name Kush. Now, all this is so very interesting, because we have all kinds of evidence of these extraordinary black races extending from the Indus right along the south of Baluchistan and Kerman and the Western Caspian; we have in the nomenclature the remains of this continuous black race, whose language is still spoken by some of the hill tribes in Baluchistan, and which proves to be so like the languages of the tribes of India. This fact arouses all sorts of interest. Before Persia was invaded and conquered by what were called the Iranians, this district was occupied by a black race speaking a language something like that spoken by some of the tribes of India. The people of Kush were the first inaugurators of culture and civilization. I am saying a few things in my simple way, but I hope something will be said about the history of Persia by the President, who has written such an admirable and interesting and condensed

account of it. It is the only history of Persia that I know now in one volume which is both readable and accurate and excellent, and I have no doubt he will tell us, when he comes to speak out of the cornucopia of knowledge which he always has at command, a great deal more than it is possible for me to tell you. I may say I have listened to the lecture with the enormous admiration one must have for the first person who, since the time of the followers of Alexander, has united India and Persia by trade and commerce, and by something better than trade and commerce—by the good reputation of an Englishman, and I am proud to number him among my friends.

The President: I am afraid it is too late to enter upon any further details of the history of Persia, but we have a duty to perform, and that is to express our thanks to Major Sykes for what he has told us and what he has shown us. Sir Thomas Holdich, a great authority, has very fully explained to us the immense value of the public services of Major Sykes in Persia by establishing the Consulship at Kerman, and by opening the trade route from Kerman to Quetta along that very country in which Alexander the Great and his army nearly perished from thirst. But what I think must strike most of us, as it has struck me, with regard to the work of Major Sykes, is the exhaustive and complete manner in which he acquaints himself with the country and the people among whom he has to live and to serve. I do not think, as a Persian traveller, that there has been one since the time of Sir Henry Rawlinson who has combined so great a knowledge of Persian history with such valuable geographical investigations. We have to thank Major Sykes, and I think we may do so, for his great public services in Persia as well as for his contributions to geography. To-night we have to thank him for his most interesting paper and for all the beautiful sketches he has shown us, and above all for allowing us to see that magnificent collection of Kerman carpets, and of the tiles which have been described to us by Mr. Read, and of the other antiquities which you will now be able to examine in the tea-room. I propose a cordial vote of thanks to Major Sykes.

THE CONGO-ZAMBEZI WATER-PARTING.*

By Captain C. LEMAIRE.

Previous to the labours of the Belgian Scientific Expedition to Katanga, the divide between the Congo and Zambezi basins had not been completely and accurately laid down, even on the most recent maps. Not a single traveller had followed it throughout its whole length, and it had merely been crossed at certain points by the routes of Livingstone, Cameron, Arnot, Capello and Ivens, Francqui and Cornet, and others. Yet geographical science (so-called) had permitted the mistaken claim to complete, though subjective, knowledge, and it is our task once more to demonstrate what are the plain objective facts of the case. But wishing as we do to speak of nothing that we have not verified with our own eyes, it is necessary at the outset to remark that we can ourselves throw light only on that portion of the Congo-Zambezi divide

* Abridged translation of Captain Lemaire's manuscript. Map, p. 248.

which is comprised between the 22nd and 27th meridians east of Greenwich.

Trusting to the observations of the travellers mentioned above, the distinguished geologist, M. Jules Cornet, whose friendship I am proud to have possessed from my earliest years, considered himself justified in making the following generalization respecting the Congo-Zambezi water-parting, in his 'Observations sur les Terrains anciens du Ka-Tanga.' He says (pp. 108–110): "The water-partings between the great hydrographical systems of Africa present a remarkable character of indecision. . . . Livingstone, Cameron, and after them Arnot, have long ago insisted on the absence of definition which characterizes the line separating the basin of the Congo from that of the Zambezi. The small Lake Dilolo, according to the observations of Livingstone, discharges its waters at the same time into the Congo and the Zambezi * ('Missionary Travels,' chaps. xvii., xviii., and xxiv.). . . . Referring to the plains of Lovale (?), Cameron says that the watershed between the Zambezi and Congo basins lies along the centre of these plains, which in the annual rainy season are waist-deep in water, and the two basins then actually join ('Across Africa,' vol. ii. chap. xv.)."

After describing the region drained by the Lualaba, Kassai, and Zambezi as a vast undulating plateau formed of ancient strata covered by superficial deposits, M. Cornet proceeds: "These superficial deposits are generally rich in clay, and at the time of heavy rains the water easily collects on this almost impermeable soil. Great swamps are formed, many of which constitute the common source of streamlets belonging to the two different basins, and often emerging from the same swamp even during the dry season. These streamlets flow slowly at first, in slightly marked valleys, broad and swampy, and little sunk below the general level. As they proceed on their courses and gradually increase in size these watercourses unite, and rivers are formed which carve out valleys, into which they sink deeper and deeper. Such are the conditions under which the Lualaba takes its rise, in a region presenting the characters just described, but with the aspect of a field covered with mole-hills, owing to the number of isolated conical hills which rise sharply above the general level."

Much of this is not confirmed by our observations, but before describing these, I must draw attention to the following points:—

1. Cornet had twice occasion to cross the Congo-Zambezi divide. The route of the expedition to which he belonged touched the sources of none of the *southern* headstreams of the Lualaba, any more than it did those of the Lualaba itself.

* It should be remarked, however, that Livingstone expressly states that he did not himself observe the northward and southward flow of the waters of the lake. His own idea had been, in fact, correct until he was assured by a native that the rivers north and south of the lake flowed in opposite directions.—Transl.

2. Cameron followed the line of which we are speaking for some time, but he crossed it but a limited number of times—five or six, apparently, according to Du Fief's map.*

3. Capello and Ivens crossed it twice; Arnot once; Livingstone three or four times; Francqui four times.

4. The Katanga expedition crossed this divide twenty-three times and followed it at intervals between the 22nd and 27th meridians east of Greenwich, passing from source to source of the rivers. Moreover, M. Voss, the geologist attached to the mission, crossed the same line twice, abreast of the Loenge.

RAPIDS ON THE UPPER KASSAI.

The region in which Cornet crossed the Congo-Zambezi water-parting lies in about 11° 50′ S., 27° 15′ E., the latter value being merely approximate. The following description given by the distinguished geologist is based on actual observation, and therefore possesses a scientific value:—

"The village of Moape is—together with that of Moasompwe, situated 70 miles further west, and almost in the same latitude—the most southerly point to which my geological researches extended. Moape

* Cameron's description of the flooded plains on the water-parting applied in the first instance only to the region immediately west of Lake Dilolo; and, though inclined to generalize from his observations here as regards the rest of the line of partition, he was careful to state that this was only an opinion, liable to alteration with the acquisition of more accurate knowledge.—TRANSL.

lies at an altitude of 4068 feet, on the extreme confines of the Congo basin. The streamlets which rise in the neighbourhood discharge their water, some to the Lufubo, a direct affluent of the Luapula, others to the Loenge, or Kafue, a tributary of the Zambezi. Streams flowing in the two directions often issue from one and the same marsh, and at the time of heavy rains, the vast swamps, which so easily form on this almost impermeable soil, serve as common sources to brooks flowing both to the Congo and Zambezi. The indefinite character of the divide, which I have before alluded to, is nowhere more remarkable than in the neighbourhood of Moape."

In thus showing that there exist in this locality sources common to streams belonging to the two great river-systems, Cornet relies on facts, which, however unusual, he has carefully established. The phenomenon may therefore be regarded as undoubtedly existent, at the points seen by him, where the water-parting will really have the indefinite character attributed to its whole course. He, however, gives credence to the statements of Livingstone with regard to the double outlet of Lake Dilolo *; while by our own examination of the lake we have shown that such a state of things has no existence. Dilolo is an enclosed bond, which, though it overflows after heavy rain into the Lotembwe, is nevertheless entirely within the basin of the Zambezi, the Lotembwe being a minor affluent of the latter, and having no connection with the Kassai. In fact, as regards strictly accurate knowledge of the water-parting between the two basins, we were limited to the personal observations of Cornet at Moape, these constituting the sum total of that traveller's acquaintance at first hand with the line in question.

In extending the character of indecision to other portions of the water-parting than those seen by him personally, Cornet draws upon the observations of other travellers—observations equally local in character, and many of them based on native accounts only. These observations, therefore, required testing, and this is what we did in the journey of which I am about to speak.

I will first, however, put down the observations made, in the region visited by Cornet, by the geologist of our expedition, Mr. Kemper Voss. Describing his passage across the water-parting between the Lufira and Loenge, and between the Loenge and the Kafubu (a tributary of the Luapula), he says—

"The first crossing was made between the Kapande, an affluent of the Mwe-mwashi, and the source of the brook Ntola, this latter flowing to the Kwemarto, which in turn flows into the Marsendarmo, and this into the Loenge. An interval of 2 miles intervenes between the Kapande and the source of the Ntola. The country in the

* Cameron's journeys had, however, previously shown that the lake had no definite outlet to the north.—TRANSL.

neighbourhood of the Kapande was slightly hilly in consequence of the presence of an important dyke running from east to west, but from this point to the sources of the Ntola the variation in level was insensible; the country is flat, and covered with trees of medium size scattered at intervals.

"The subjacent formation was found to consist of grey schists. The source of the Ntola lay in a wide open space covered with grass, with a fringe of wood. This space had a width of 500 metres, and stretched towards the east, the whole forming a shallow valley, along the centre of which ran a narrow riband of water, into which the overflow of several pools was collected. The path crossed the western

NEAR THE SOURCES OF THE LUKULESHI.

extremity as well as the end of the shallow valley, the second passage being situated between the village of Chikolo and our camp at the brook Kekanda.

"From Chikolo to the source of the Letube rivulet, an affluent of the Loenge, the country was flat or gently undulating. The Letube, at the point where the path crossed it, presented a dry bed, only 5 feet wide, the passage being made near its end. About 3 miles further on another stream-bed, similar to that of the Letube, but running from west to east, was met with; it debouched into the Mesamba, which in turn joined the Kafubu. It was therefore evident that the water-parting had been crossed, the country presenting the same character as between Chikolo

and the source of the Letube. The underlying formation consists of grey schists all along the track."

I now come to our own reconnaissance along a portion of the water-parting. At the middle of July, 1899, the expedition was on the Lualaba, at the village of the chief Kazembe, in 10° 45′ 11″·56 S., 25° 46′ 44″·86 E. Our official instructions directed the leader of the expedition to examine the southern boundary of the Congo State as far as Lake Dilolo. Now, from Kazombe's village we could make our way to the lake by the route followed for years, perhaps for centuries, by the black traders coming from Portuguese West Africa, who go by the name of "Wambundus," or sometimes "Bimbalis," that is to say, people of the west. In spite of the many travellers who have made use of this road, no survey, in any degree satisfactory, has yet been made of it, and something was therefore to be said in favour of its selection by our party. I, however, came to the conclusion that, in order to obtain a notion of the most interesting points to be visited on the divide, it would be a good plan to keep at a distance of 30 to 60 miles to the north of that line until, marching westward, we should have reached the Kassai, then turning south to Lake Dilolo, and thence following the water-parting as far as possible from west to east. The outward march would thus take us across the principal streams descending from the divide, at points where they would already be of sufficient size to show their relative importance, and we would in this way know which to examine more particularly at their sources during the return journey.

It is unnecessary here to describe the first part of the route, starting from the Lualaba. I will merely mention the principal rivers crossed. They were—the Kolueshi, Lualu, Lufupa, Luawo, Lubudi (or Lube), Lukuleshi, and Lungenda, all carrying their water to the Lualaba; and the Mutembo, Lukoshi, Lulua, Lusangela, Futweshi, and Lulonga, all belonging to the system of the Kassai, which was reached on September 5, 1899, astronomical observations made the same evening giving the position as in 10° 30′ 47″·95 S., 22° 16′ 22″·97 E. I had been able to make out that points to be visited later by us were the sources of the Lufupa, Lubudi, Lukuleshi, Lungenda, and Lulua, all of which were stated by the natives to have their "Kassulo" (source) near the Jambeji (Zambezi). We had found the Lukuleshi to be, to all appearance, more important than the Lubudi, which latter even the natives asserted to be a tributary of the Lukuleshi. This fact was of interest in connection with the determination of the sources of the Congo, a subject which I have dealt with elsewhere.

The Kassai, at the point at which we struck it, had none of the beauties usually associated with tropical rivers, flowing as it did between sandy banks bordered by bare and level plains. There were rapids both above and below, but beyond these in the latter direction the river was said to be navigable for eight days. Its water was clear, its

current rapid, and its breadth 170 yards, with depths varying from 5 to 10 feet. On September 7 a southerly course was taken for Lake Dilolo, the route leaving the Kassai and ascending its tributary, the Luao. This having been crossed, the track continued to ascend over a *massif* composed chiefly of limonites, which bounded the view to the west, while eastwards the view ranged over a wide level country. On the two following days a number of clear and rapid streams were crossed, all flowing either to the Luao or its tributary, the Ngoana, which last, like so many of these streams, flowed in a spongy depression. The country was covered with a network of paths, and many groups

THE KA-KOLA STREAM, ON THE CONGO-ZAMBEZI WATER-PARTING.

of huts were seen, the inhabitants proving friendly and confiding. Eruptive rocks were seen in the form of quartz-porphyry and mica-schists, while sand began to predominate in the superficial deposits. On September 10 an interminable sandy plain was reached, covered in parts by short turf, in parts by clumps of trees. The route led up the narrow depression of the Chimeto, an affluent of the Ngoana, the course of which is marked by a strip of "gallery" forest. South of its sources, well marked by a "sponge" at which the gallery forest ceased, there extended a plain of white sand, fatiguing to traverse, giving place here and there to an orchard-like landscape. Soon the track, which maintained a direction from north to south, cut at right angles the famous Wambundu trade route, used by the black traders from Portuguese

West Africa, which is formed of half a score of parallel tracks, and follows the easiest route from the coast to the sources of the Zambezi; its advantage consisting in the fact that it is not closed by the inundations, at least at this point, for, according to the assertions of the natives, the plain is covered by water to a depth of 6 to 8 inches for one month only during the rains. The deep sandy soil easily absorbs the water, which is stored up in a subterranean stratum, reached by digging to no great depth. The holes formed at places along the route by passers-by contained, however, very little water, and the caravan therefore suffered from thirst before reaching the Luvua, where a plentiful supply was obtainable.

The country was here characterized by the great abundance of a dwarf palm, met with for the first time, but which proved typical of the line of water-parting. It has a flattened stem, with leaves imbricated laterally, and rarely exceeds a height of 5 to 6 feet. It became evident that the watershed had been crossed on reaching the dry tree-fringed bed of the Kandungila, which runs into the Luvua, a sub-tributary of the Zambezi. The Luvua, the water of which is clear, but with an imperceptible current, is an affluent of the Chikalueshi, which runs to the Kifumaji, and this to the Jambeji. Camp was pitched on this day at the village of the chief Chimuli, of the Baluena race, in lat. 11° 15′ 58″·44 S., long. 22° 2′ 49″·90 E., at an altitude of some 3800 feet.

The regular spheroidal form of the country, and the presence of a stratum of water at a depth of 5 feet at the different holes met with, point to the conclusion that the surface is in quasi-agreement with the surface of equilibrium of the terrestrial spheroid; while the evenness of the country would seem to lend itself well to the measurement of an arc of the meridian. The water-parting, although not marked by any mountainous relief, was perfectly definite. The Chimeto, the last affluent of the Kassai basin, had a rapid current, and had nothing of the character of a marsh. The Wambundus have naturally aligned their trade route along the water-parting in order to avoid the marshes and spongy valleys, which occur, not on the divide itself, but in the well-marked basins of the Luao and Luvua.

Lake Dilolo was reached on September 11, and left again on the 18th, the expedition having passed round its western and southern shores. On the 20th the Luvua was recrossed, and the journey continued in a general north-easterly direction across a monotonous sandy plain. For the next two months the route followed more or less closely the line of the water-parting, crossing and recrossing it into one or the other of the two great river-basins. It was everywhere found to possess the same general character, no interlacing of the two systems being observed. Towards the end of September, at the very close of the dry season, it was noticed that the streams flowing to the Kassai showed no signs of failing, while the northernmost feeders of

the Zambezi were dry. On this side the hydrography was by no means clearly marked, the whole country forming a sort of spongy magma, with a gently undulating surface and a sub-soil of limonite. The water collects in the hollows between the undulations, forming a kind of river-bed, but without any current. Local and temporary movement of the water naturally takes place after heavy rains, and the surplus finds its way to the Zambezi, but there are no rivers properly so called.

On September 22 two Portuguese traders, travelling in ox-waggons to the coast with a freight of caoutchouc, were encountered. The meeting was particularly interesting, as sufficing in itself to disprove

THE PEMPERE LAKELET, NEAR THE CONGO-ZAMBEZI WATER-PARTING.

the legend of the swampy water-parting, while at the same time showing with what ease the iron road might advance along this route.

The fourth crossing of the watershed was effected between the sources of the Mashibi (Zambezi basin) and the Lupunga (Congo basin), the country presenting the typical character of a sandy plain sprinkled with stunted shrubs. The readings of the aneroid brought out clearly the "hog's back" form assumed by the divide at this spot, the route ascending gradually some 30 feet from the source of the Mashibi to fall the same amount on the other side. On this day (September 24) camp was pitched near the important group of villages subject to the chief Niami Tenga at an altitude of some 4000 feet.

Another large assemblage of huts was passed the next day, all being supplied with water from numerous wells, 5 feet deep. The rainy season was ushered in by a storm which lasted five hours, it being the first really wet day experienced. On the 26th the basin of the Lulua was entered, and it was decided to leave the trade route and make for that river, in order to trace it to its source. It was reached the following day at a point where its breadth was about 8 yards, the water flowing strongly, with a depth of 2 to 3 feet, between sandy banks 6 to 10 feet high. We found to our surprise that its direction was from east to west, and on our inquiring the whereabouts of its sources, our guides pointed to the east and even to the east-north-east. We held on our course through a wooded and partially cultivated country, along the right bank of the Lulua, rejoining the tracks of the ox-waggons, and reaching the houses of their owners at the large settlement of the chief Katende. This was said to be two days' march from the Portuguese post of Nana Kandundu, camp being made *en route* on the Luachi, an affluent of the Zambezi. On the 30th it was found that the Lulua, now a mere thread of water, came from the north-east, and that its source was not on the main divide. It was decided, therefore, to leave the river and proceed eastward, the water-parting being soon reached once more. The courses of the streams were clearly marked by strips of gallery forest, and were always assigned by the guides, without the least hesitation, to one or the other of the two basins.

On October 2 we went north-east and crossed the Luashi (not to be confounded with the Luachi mentioned above), which we found to flow from east to west, like the Lulua. Its bed was strewn with blocks of granite, which also appeared in the form of huge domes, the country becoming somewhat more broken. Our path now seemed to bend too much to the north; we therefore re-crossed the Luashi and held on towards the east-south-east, until we reached a stream flowing from north to south, which proved to be the Kaluila (Zambezi basin). Following this up, we reached its source and climbed a well-marked glacis, coming to a veritable hydrographical knot, whence the waters of three important basins, the Kassai, Zambezi, and Lualaba, can be seen at once. On October 6 we reached the Lukuleshi, the sources of which I proposed to examine. It flowed in a deep depression with steep sides, and, where crossed by a native bridge, had a width of about 8 yards, with a depth of 3 feet. On the 8th we ascended its course for a time, afterwards crossing it and proceeding over a broken country, which rose gradually to the extent of 350 feet. The geological formation consisted at first of soft horizontal sandstone, then of hard sandstones, forming a wall of rocks sometimes 70 feet high, and lastly of greenish schists, limonites, and rolled quartz boulders. On the 9th the route was continued up the left bank of the Lukuleshi, which was bordered by a steep cliff furrowed by deep gullies, the bottoms of which were formed

by a narrow strip of sponge. The source of the river lay in a small spongy meadow, into the surface of which the feet sank, causing the water to well up from below. The altitude at the source of the Lukuleshi was 5085 feet, and the position 11° 24′ 3″·71 S. lat., 24° 27′ 0″·85 E. long. Towards the west the country rises into a ridge, by crossing which we should have come to the sources of the Zambezi (Jambeji), which are quite close. Continuing our march on the 10th, we ascended rapidly over ground composed of schists and hard quartzites, until we gained an extensive view southward over the upper basin of the Zambezi. A blue rising ground seemed to occupy the far southern horizon, the intermediate area forming a widely undulating wooded country.

THE LIMESTONE PLAIN OF JI-WUNDU.

Crossing the divide for the ninth time, we found, 400 feet below the crest, the Luakera, a fine stream which comes from the west-south-west, and, turning south, joins the Lunga, one of the great feeders of the Zambezi. It is interesting to note that, in the first part of their course, the Lukuleshi and Luakera flow parallel to each other and to the divide, here formed by a well-marked ridge, which is but slightly furrowed by brooks on either side. This parallelism between the principal streams of the two basins near their sources had already been several times noticed; the most striking example being supplied by the Lulua and its tributary the Luashi, both of which have their sources to the north away from the main divide. In the west the Kassai

likewise flows at first parallel to the divide, and in the east the Lualaba begins by flowing from east to west before taking its normal northerly direction. The Lunga also, found by M. Questiaux, on descending the Luakera to the confluence, to be a large stream 15 to 20 yards wide, has in its upper course a similar parallel direction.

The source of the Lubudi was our goal on October 19. Crossing the water-parting, we found that both the aspect of the country and the flora changed suddenly, the spongy meadows and sandy plains giving place to clays and vertically bedded schists, etc., while edible figs and wild vines made their appearance. The divide, thoroughly well marked as usual, had here an altitude of about 4750 feet, and the source of the Lubudi lay half a mile to the west of the path. On the 20th we left the Lubudi, the immediate banks of which are very rugged, and entered the basin of the Lufupa, passing first over a broken country with clear rapid streams overhung by galleries of foliage, amongst which bamboos and euphorbias abounded. On the line separating the two streams we came once more to the sandy plains and streams with spongy banks, characteristic of the line of the trade route, though we were now far away from this. From the source of the Lufupa, which lay in a vast basin surrounded by hills, we proceeded eastward, crossing and re-crossing the divide and reaching the western extremity of the basin of the Lualaba proper. The beds of the streams passed *en route* were absolutely dry, although the rains had now been with us for a month, and it was only by digging holes that we obtained some bad water of a yellowish colour.

We now turned off towards the south, with the intention of reaching the source of the Pemba, shown on existing maps as a left-bank tributary of the Lualaba, coming from a long distance in this direction. After 7 or 8 miles we crossed the narrow valley of the Lufunfu, and, continuing our southerly course on the 25th through an uninhabited wilderness, in spite of the opposition of the guides, crossed the Mufwa before camping in 11° 30′ 13″·37 S., 25° 34′ 17″·41 E. The country was broken, and consisted at first of siliceous rocks impregnated with oxide of iron, afterwards of reddish schists, bedded vertically, which further on were traversed by veins of iron ore partially crystallized. Having reached the Muyafunshi on the 26th, I considered that we might have wandered too far from the divide, and therefore changed our course for the west-north-west, pitching camp on a large outcrop of quartzite overlying a mass of foliated iron ore. The following day we passed near the sources of the Lufunfu, and crossed the divide for the fifteenth time, camping at an altitude of 5250 feet. To the east of our camp the country rose rapidly, while to the west we looked over a vast wooded plain, through which flowed the Lunga. The source of this river, a welling spring of clear water at the bottom of a semicircular depression, was reached on the 28th, and from it the source of the Kapombo,

IN THE LIMESTONE VALLEY OF THE JI-WUNDU.

at a distance of 2 miles to the south, the interval being occupied by a dome-shaped rising ground, which marked the divide as clearly as a sharp ridge would have done. On the 29th, the route led south and east across a half-wooded even country; but on the 30th the many streams crossed flowed at the bottom of well-marked depressions. Very hard siliceous schists, of a bluish-grey colour, were seen on the banks and in the bed of the first of these, the Kamalenge. Most of the streams flowed either to the Muyafunshi, or the Mualaba, both of which eventually enter the Lualaba. The Mualaba having been reached, camp was pitched on the banks of a fine lakelet without outlet, named Pempere, in order to permit M. Questiaux to visit the source of the river on the following day.

This day's march had been particularly interesting for the following reasons. Speaking of the sources of the Lualaba, M. Cornet had called attention to the discrepancy existing between his own survey and that of Capello and Ivens, which led him to conclude that the Lualaba of these travellers was really the upper course of the Lubudi. Their route appears to have followed the divide, and, if so, must have coincided with our own. Yet on transferring our itinerary to their map, an enormous difference is seen to exist between the two routes. Now, Capello and Ivens used only a sextant, the defects of which, especially for the determination of longitudes, have been insisted on by such writers as Delporte, the first observer to carry out accurate geodetic

observations of the Congo. For our survey we used a meridian circle, constructed according to his suggestions, and three geodetic points of the first order were fixed by us on the line of the water-parting by the method of lunar culminations, so that there could be no comparison between our results and those of Capello and Ivens. If the longitudes] of these travellers are corrected, we find that their Lualaba and Kisora may quite well be the Mualaba and its affluent the Kisora seen by us on the 30th, though the latter is a left-bank, not a right-bank, affluent. In any case the Lualaba of Capello and Ivens cannot be the Lubudi, the sources of which were seen by us in 24° 57′ E.

Resuming our journey on November 2, we entered the wide bare valley of Ji-wundu, bounded to the south by a slight rising ground beyond which rose the peaks of Makuyu and Milunga. Here the divide was twice crossed, a careful examination of the valley (where we stayed for some time in order to determine the longitude by lunar culminations) showing that no connection exists between the waters of the two basins. During our halt, the sources of the Pemba were visited by M. Michel, and found to lie a degree further north than has hitherto been shown on our maps. On the 17th we traversed a kind of plateau, with a glacis facing south. It was covered with a thin undergrowth, more luxuriant in places, the soil being generally good. The only geological formations visible were limestones, which continued to show a north-and-south strike, and were strongly tilted towards the east.

CAMP ON LAKE DILOLO.

Towards the end of the march small hexagonal prisms of marcassite (white pyrites) and of biotite were observed. On the 18th we reached the Kalulwa peak, where we linked our survey with that of M. Cornet. During the first part of the route the limestone was hollowed into basins, in which the water accumulates after rain; but later on streams were seen flowing to the Lualaba, the country becoming very broken. From the Kalulwa peak we sighted a double peak towards the east-south-east, named Ditemba, towards which we marched on the 19th, across an undulating country. Almost everywhere there was a rich red soil, which supported a vegetation no longer stunted as heretofore, though still somewhat scattered.

CAMP AT THE SOURCES OF THE LUALABA-CONGO.

The sources of the Ditemba and Mutanda were visited on the 20th and 21st. The latter, which flows in a steep-sided valley, is an affluent of the Loenge, one of the main feeders of the Zambezi. The route led through an uninhabited wilderness, the surface being characterized on the 21st by great regularity. A white quartz, limonite, and a greenish eruptive rock were the geological formations noticed. On the 22nd we went south, leaving to the north the Musofi peak, to the sources of the river of the same name, whence the route turned northward to a spongy depression containing the source of the Mitutu, a tributary of the Lualaba. The amount of water supplied by the sponges is very remarkable, for at a distance of less than 2 miles from its origin we had found a rapid stream 4 yards wide and 2 to 3 feet deep. After passing the Mutobwe, which flows in a deep valley to the

Lufira, we reached a wide grassy plain, somewhat below the general level, which gives birth to the Lualaba. It differs in character from the spongy plains so often seen, being in great part dry, except after heavy rains. We camped at an approximate altitude of 5000 feet in 11° 45′ 29″·01 S., 26° 32′ 17″·17 E.

On the 23rd M. Questiaux descended the Lualaba for some 10 miles. The grassy plain on which our camp was pitched runs north for 2 miles, and then makes a bend to the west. The stream first acquires a definite bed a mile and a quarter below the camp, where it is sunk about 2 feet below the plain, is 3 feet wide, 1½ feet deep, and runs with a brisk and clear current. At the lowest point reached by M. Questiaux, below the embouchures of the Mitutu and Musofi, it had widened to 20 feet, with a depth of 2 feet. The meadow through which it flows has a width of from 200 to 750 yards, and is spongy in places. It is bordered by gently rising wooded hills, 30 to 50 feet above the bottom of the narrow valley. From the fact of our having crossed a stream belonging to the Lufira basin before reaching the sources of the Lualaba, it will be seen that the latter do nôt lie on the Congo-Zambezi water-parting, from which some of its left-bank tributaries take their rise. Our guides declared that all they could now do was to take us to the chief Kichaba on the Mwemwashi, an affluent of the Lufira, and I decided to let them do this, planning to pay a visit to the sources of the Lufira from the chief's village. This was reached on the 25th, the route having led north-east over a very broken country. The Mwemwashi, a mile east of which the chief's village was placed, proved, contrary to expectation, to be a right-bank tributary of the Lufira, which lay entirely north of our route. It, in fact, bends to the west in its upper course, and its sources lie some distance north of those of the Lualaba.

The Mwemwashi was a large stream, and was said to come from a long way south. I therefore resolved to make its sources my objective, although the country in this direction was said to be absolutely deserted. Leaving the bulk of the caravan at Kichaba's, I started south with a light column. The river runs in a narrow valley, which became deeper as we proceeded, the uninterrupted succession of ravines by which the valley-sides were furrowed rendering the march very trying. Crossing the river at a point where its width was from 4 to 6 yards wide, and striking due south across what appeared to be a bend of the stream, we again reached it on December 1, after traversing an exceedingly uneven country. Climbing the further side of the gorge, we continued south by good elephant tracks, and reached a hill of magnetic schist, which influenced the compass. It was formed of huge masses of rock falling precipitously towards the south. Descending by a sort of giant's staircase, we found ourselves on a low plain enlivened by a herd of twenty-five zebras, but without a trace of human beings apart from a deserted hunting shelter. We wished to camp, but, finding no

water, were compelled to make a circuit, which brought us to the sources of the Mwemwashi, in 11° 58′ 23″·66 S., 26° 53′ 51″·33 E., the altitude being about 4900 feet. On December 3 M. Questiaux pushed south, and after 5 miles reached the sources of a stream flowing south, which he followed for 2 or 3 miles. The water-parting had therefore been crossed for the twenty-third time, and once again at a point where any commingling of the waters of the two basins would be an impossibility.

Here our work ended, as far as the examination of the water-parting was concerned. Conscientiously as it was carried out, it is still far from complete, and could with advantage be taken up afresh by a subsequent traveller visiting the region six months earlier in the year, so as to learn the hydrographic conditions at two entirely different seasons. Nevertheless, we trust that we have established a certain number of fixed points in regard both to our notions respecting the water-parting and to its mapping. Such points are definite gains to knowledge, and not the vague suppositions which must in time be swept away.

JOURNEY TO MOROCCO CITY.*

By Captain P. H. FAWCETT, R.G.A.

Although breaking no new ground of exploration, the accompanying route-map may be of some interest to travellers in Morocco. A few latitudes appear to have been previously observed, but no reliable computation of longitude, partly because of the difficulty attending exploration in most parts of the country, and partly because the enterprising travellers, who from time to time have mapped routes, have unfortunately not been versed in the methods of scientific surveying. There is, therefore, no point in the interior of Morocco which has been reliably determined for longitude, and the result is that all existing maps of the country are merely a compilation of estimated distances, supposition, and native information. European travellers in the country know how little the maps can be relied upon. On this particular journey (1901), which was a short and simple one, the observations for longitude were doubly checked, firstly by the triangular nature of the journey, which commenced and ended at fixed points on the coast; and secondly by the route from Mogador, almost due east, being followed by that to Mazaghan, almost magnetic north. All observations were taken with a 6-inch sextant and folding-roof artificial horizon. The watches used for the determination of the longitudes were two in number, and were checked at Mogador and Mazaghan. They were rated at both these places, as well as at Morocco city, and the daily rate of the best watch, a very fine half-chronometer, worked out at precisely

* Map, p. 248.

the same at all three points, namely, 2·093 seconds gaining; and, as a matter of interest, retained this rating within $\frac{1}{100}$ part of a second until November 18, when it was last checked; which record, as the watch was kept swathed in cotton-wool and clothing during the journey by mule to and from Morocco city, and was worn on a chain from October 26, is a singularly good example of what a watch can do.

Unfortunately, owing to limitation of baggage, and doubts as to the advisability of carrying too many surveying instruments, a telescope was left behind, thus precluding the observation of an occultation, a useful check. The nights at Morocco city, however, were, as it happened, cloudy, and the observation might have been impossible.

Civilization has sufficiently penetrated Morocco for the routes from the coast to both Fez and Morocco city to be safely and frequently traversed by Europeans. Tangier, Tetuan, Oujda, Fez, Mequinez, and Rabat, are about the limit of safety in the north; although there are stories of German naturalists who, without escort, have traversed the whole Atlas range. Beyond the safe routes, however, some sort of Moorish disguise is considered necessary, and even then the journey is attended with very great risk.

From Morocco city a foreigner can proceed safely north, south, or east, until such time as he is stopped. The chance of murdering a European in order to thrust the blame on neighbours is a sore temptation in a country where the tribes are at perpetual enmity with one another, and the Government has a limited radius of control. Animals, or loot, alone are an attraction. However, the friendly tribe in whose territory the traveller has received protection, know too much to permit an advance—even if Moorish officialdom has not given a hint to that effect—if there is any risk, knowing full well that their villages and property are the probable price exacted as punishment for any mishap. A great deal of useful information remains, however, to be acquired in the safer districts.

The journey to Morocco city itself is not uninteresting; and the city is well worth a visit, if only to gain an impression of life as it was a thousand years ago amongst these people. From Mogador the route passes over sand-hills and through Argan forest into a region of valley and undulating hills until Tirbzan is reached, from which it crosses a succession of cultivated plains to Morocco city. Shooting is excellent all the way, the country teeming with partridges, sand-grouse, and hares. During the rains the plains are said to be prolific in wild-bird life of all descriptions; but travelling at this time of the year, when rivers are sometimes impassable and the plains quagmires, is fraught with a certain amount of discomfort. After leaving Tirbzan the snow-clad peaks of the Atlas come into view, rising majestically some 50 miles to the east and south-east. The Atlas range forms the chief feature of the picturesque plain of Morocco, and is chiefly responsible

for the climate of that interesting city. Gundaffi to the south-west, Iglowi about south, and Jebel Ayashin about south-east, are the most prominent peaks. The two former are open to travellers; but Jebel Ayashin lies in dangerous country. The plain of Morocco has a height above the sea of about 1500 feet.

All the heights on the route-map were obtained by aneroid barometer. As they were worked up carefully from Mogador, and checked back without any apparent discrepancy to sea-level at Mazaghan, it is presumable the record is correct within a reasonably narrow margin. From Morocco city to Mazaghan the route rises to the Jebelet hills, and, except for a slight recovery at the Jebel Akhdar, falls gradually over a succession of open and fertile plains to the coast. There appears to be no other name amongst the natives for the Jebelet hills except Jebelet. This means "hills," and presumably applies in a similar way to our frequent appellation of "the mountain." The highest point is 3268 feet above sea-level, and from this point a most magnificent view all round the compass is obtained. An interesting feature of the route is the old Portuguese fort of Gurrundu, a ruin standing on a commanding hill in the Jebel Akhdar, and which lends its name to the locality. Another similar ruin exists at El M'Til, on a hill known as Jebel Luxaia. Both these old forts, relics of Portuguese enterprise, have a number of subterranean passages and chambers hewn in the soft sandstone rock—places of refuge, probably, against Moorish attack. Those at Gurrundu are still open to an acrobatic visitor, but at El M'Til time and weather have combined to leave only few traces. Nearer the coast the number of exceedingly deep wells are somewhat of a curiosity. All these wells reach sea-level for their water, and the deepest plumb over 300 feet to the surface of the water. It is said that one is in existence with a depth of 600 feet. When it is considered that all of them have a diameter of only about 3 feet, and were ascended and descended by means of notches cut in the side, their construction is no small feat. The wells are absolutely plumb, and were dug by an enterprising man from the Sus, some fifty years ago, who was clever enough to make a small fortune on the assumption that water must exist when sea-level was reached. The villagers still have a profound veneration for the man who could tell that water could be found at such a depth.

On both routes a considerable quantity of iron was noticeable, particularly on that from Mogador, and in the Jebelet hills. A compass in the latter is almost useless. The plains are covered with small stones, chiefly flints, and water-worn; and there are extensive outcrops of conglomerate, which point to the existence of lakes or large rivers at some remote period.

Marine shells are found in the hills at El M'Til.

As a country full of valuable mineral resources, Morocco is probably vastly overrated like most other comparatively little-known places.

The inaccessibility of the Atlas, and the greater part of the country generally, is probably responsible for the presumption. Gold is panned in very small quantities from the streams in the Sus and Draa districts, and copper is worked at Tarudant. Rumour has it that a valuable gold-mine is worked in the neighbourhood of Gundaffi, but Europeans who know the country, and the people, are very sceptical. Mining concessions are extremely unlikely to be granted as long as the present sultan is in power. The real value of the country lies in agricultural development. It is the potential granary of Europe. It is a singular anachronism that, with great possibilities, such a lack of civilization should exist in close proximity to Europe, and that actually on the Mediterranean coast, virtually in view of Gibraltar and Tangier, should exist strips of country into which it would probably cost a European his life to penetrate. And yet such is the case in this twentieth century of civilization and progress, thanks chiefly to international jealousies.

PRECIPITATION ON MOUNTAIN SLOPES.

In a paper published in the *Annalen der Physik*, 1901, vol. iii. pp. 459–480 (translation in *Monthly Weather Review*, April and July, 1901; abstract in *Meteorologische Zeitschrift*, July, 1901), Prof. E. Pockels, of Dresden, makes a very important contribution to the theory of the formation of precipitation on mountain slopes. Ever since it has been recognized that the principal cause of the condensation of vapour in the atmosphere is the adiabatic cooling of ascending air, the direction in which an explanation of the increased rainfall on the weather side of a mountain range must be looked for has been sufficiently obvious, but except in the case of the stratum of air actually in contact with the slope, of which the rate of ascent is directly known, no attempt has been made to solve the difficult quantitative problem. Prof. Pockels makes a series of assumptions which, although seldom or never fully realized in practice, sets forth a typical case capable of mathematical treatment, and sufficiently approximating to actual conditions to afford valuable guidance in discussing special conditions. The assumptions are six in number, and are as follows: (1) the current of air must be steady; (2) it must be continuous and free from whirls; (3) it must flow everywhere parallel to a definite vertical plane, and consequently depend only on the vertical co-ordinate (y), and one horizontal co-ordinate (x); (4) the internal friction, as well as the external (or that due to the Earth's surface), may be neglected; (5) at great heights there must prevail a purely horizontal current of constant velocity. As to the configuration of the ground, it is assumed, in accordance with (3), that the profile curves are identical in all vertical planes that are parallel to the plane of xy; (6) the surface profile is assumed to be periodic, *i.e.* a series of similar ranges of mountains. Prof. Pockels first attacks the hydrodynamic problem of the movement of the air over a rigid surface of given shape. Forming and integrating the differential equation of the stream lines, he obtains two quantities which appear as parameters that can be chosen at will, the one representing the altitude of, and the second the horizontal distance between, the mountain ridges. As a first example, a profile curve obtained by a Fourier series is chosen, which corresponds as closely as possible to a flat, broad valley and a plateau-like mountain range, and gives nearly the same conditions on

the slopes of a mountain as if it were struck by a uniform horizontal current of air; in this curve λ, the distance between two ranges is 60 kilometres (37·2 miles), and the difference in altitude between the centre of the valley and the centre of the mountain 900 metres (2953 feet), while the ascending gradient is nearly all confined within 10 kilometres of horizontal distance.

In order to investigate the condensation of aqueous vapour which occurs, the assumption is made that the ascending mass of air experiences an adiabatic change of condition, and that adiabatic equilibrium prevails in the horizontal current of air approaching the slope; the air therefore becomes saturated at a certain altitude, which can be computed from the temperature and humidity at the surface of the valley. Hence the amount of vapour condensed over unit area in unit time between given altitudes can be calculated, and if it is assumed that the condensed water falls vertically downward, this represents the precipitation on a given part of the slope. Prof. Pockels gives the following results of a particular case for the profile already described. The current of air striking the mountain has a pressure of 760 mm., temperature 20° C., and humidity 9·0 grammes of water per kilogramme of air; the upper limit of the clouds is assumed to be 5000 metres. Then, using Hertz's diagram, the lower limit of cloud is at an altitude of 950 metres above the bottom of the valley, or 50 metres above the summit of the mountain, an altitude where the temperature is 11° C. At 5000 metres the temperature has sunk to −13°·6 C., and the humidity to 2·5 grms., and the temperature of 0° C. is reached at 3000 metres. The values of the precipitation obtained for a current having a mean horizontal of 1 metre per second (2·24 miles an hour) are, if the origin ($x=0$) be at the middle of the slope—

Value of x.	0	$\pm\frac{\lambda}{24}$	$+\frac{\lambda}{12}$	$\pm\frac{\lambda}{8}$	$\pm\frac{\lambda}{6}$	$\pm\frac{\lambda}{4}$
Precipitation in millimetres per hour	1·70	1·47	0·867	0·355	0·029	0

or, if we now reckon from the middle of the valley to the middle of the mountain, we have approximately—

Distance from centre of valley. Miles.	Height of ground above centre of valley. Feet.	Precipitation. Inches per hour.
0·0	0	0·0
3·1	−23	0·0011
4·7	−33	0·0140
6·2	138	0·0341
7·7	709	0·0579
9·3	1476	0·0673
10·9	2244	0·0579
12·4	2815	0·0341
14·0	2985	0·0140
15·5	2976	0·0011
18·6	2952	0·0

The precipitation is found to be heaviest about the middle of the slope of the mountain, where that slope is steepest, and for the very moderate wind velocity of 7 metres per second (15·7 miles an hour), it amounts to as much as 12 mms. (0·47 inch) per hour. A comparison of the curve of precipitation with the curve of the mountain profile shows that, although the greatest precipitation coincides with the steepest slope, the amount of precipitation diminishes more slowly toward the planes of the

valley and the mountain plateau than does the slope of the ground. The effect of a mountain slope accordingly makes itself felt in the plain in front of that slope and beyond the summit—results agreeing with actual experience. The fact that the observed maximum precipitation is usually more towards the mountain ridge is doubtless explained, at least in part, by the horizontal drifting of the condensed water by the current of air.

Prof. Pockels next discusses the case where the lower limit of cloud is not, as in that just dealt with, higher than the summit of the mountain. Taking now the distance between ridges (λ) as 24 kilometres, and the bottom of the valley as 100 metres above sea-level, and assuming the barometric pressure in the valley as 750 mm., temperature 23° C., humidity 10 grms., upper cloud limit, 4000 metres above sea-level, we find from Hertz's table that the altitude of the lower cloud limit is 1120 metres. The heights and amount of precipitation obtained are as follows, for a current of 1 metre per second:—

	Distance from centre of valley. Miles.	Height above centre of valley. Feet.	Precipitation. Inches per hour.
Lower half of cloud	0·0	0	0·0
	0·6	495	0·0398
	1·2	1988	0·0772
	1·9	2986	0·1094
	2·5	4905	0·1339
In the cloud	3·1	5633	0·1378
	3·7	6808	0·1157
	4·3	7251	0·0768
	5·0	7398	0·0346
	5·6	7546	0·0

The concluding section of the paper deals with the assumption that the distribution of temperature in the current of air impinging on the mountain side corresponds with the condition of indifferent equilibrium, an assumption which the balloon observations of Berson and Süring have shown to be not usually fulfilled. Employing the mean values deduced from the balloon observations by von Bezold, a series of lines of flow is computed, and the altitudes of the cloud limits, and amounts of total condensation, are determined for summer and winter. It is to be noted that the method described cannot be applied in computing the mean precipitation for a given interval of time by introducing mean values of temperature and humidity.

VARIATIONS IN THE LENGTH OF GLACIERS.*

In the introduction to this second part of his memoir on the variation in the length of glaciers, M. Rabot gives a critical discussion of papers on the classification of glacier forms which have appeared since the first part was published in 1897, and more especially those of Drygalski, Richter, and Russell (*Geographical Journal*, December, 1898). The bases of classification are, in effect, two: (A) according to the intensity of glaciation; and (B) according to topographic forms of the glaciation. The former is substantially that of Drygalski, and the latter that of Rabot.

* "Les variations de longeur des glaciers dans les regions arctiques et boreales." Par Charles Rabot. Extrait des *Archives des Sciences physiques et naturelles*, 1899 et 1900.

A. Classification according to the intensity of glaciation.

I. *Inland Ice.*—This class includes the inland ice of Greenland, the ice-sheets of North-East Land and White island in Spitsbergen, of Grant Land in the North American archipelago, and probably of some of the Iceland glaciers, such as the Vatnajökull and the Myrdallsjökull.

II. *Highland Ice* (Hochlandeis).

1. Local ice-cap, or "plateau gletscher." Local ice-cap of Disco and Nugsuak, in Greenland, several Iceland glaciers, Jostedalsbrae, and part of the Svartis in Norway.
2. Composite glaciers (Alpine-Norwegian). Oxtinder Sulitelma.
3. Alpine glaciers. (*a*) Glaciers properly so called;
   (*b*) "piedmont" glaciers (Alaskan type).

B. Classification according to the topographic facies.

I. *Inland Ice.*—This class includes all glaciers covering plateaux, or, in alpine regions, those attaining such intensity that the rock elevations are always entirely covered by ice. It comprises the "inland ice" and the "local ice-caps" of the preceding classification, as well as "Kalotten-gletscher."

II. *Composite Glaciers.*—The Alpine Norwegian.

III. *Alpine Glaciers.*—(*a*) Glaciers properly so called;
(*b*) "piedmont" glaciers (Alaskan type).

While accepting Drygalski's classification as logical, M. Rabot points out that in the present state of knowledge, its general application is beset with difficulties. We do not know, for example, whether the movement of the ice in the Iceland sheets is dependent on the relief of the ground surface or not.

The main part of M. Rabot's memoir is devoted to an exhaustive examination of all available material connected with the glaciers of Spitsbergen, Franz Josef Land, and Scandinavia. The examination falls, in general, into two parts, the forms and distribution of the land ice, and the variations in quantity, as indicated by the length and volume of the glaciers or otherwise, which have taken place within historic times. With regard to the second part, the conclusions reached are three, which hold good equally for Greenland, Iceland, Jan Mayen, Spitsbergen, Franz Joseph Land, and Scandinavia. (1) Before the eighteenth century the glaciers were much less widely distributed than at present, and this minimum condition had continued for several centuries. (2) During the eighteenth and the first few years of the nineteenth centuries, an enormous increase occurred, exceeding the limits of a simple variation—the glaciers invaded regions which they had never occupied during the actual period. This increase was general, and affected the whole of the northern hemisphere. (3) The variations during the nineteenth century were indefinite. In some regions a considerable augmentation occurred, followed by a slight diminution, while in others the glaciers, after remaining in a condition of maximum until the beginning of the century, suffered a slight diminution. In no part was there a regression comparable to that observed in the Alps during the last fifty years.

In attempting to compare the mode of variation of the glaciers of high latitudes with that of the Alpine glaciers, M. Rabot examines his results in relation to the three propositions laid down by Forel: (*a*) The law of long periodicity, variations continuing for periods of ten or twenty years; (*b*) the law of simultaneousness, variations of similar sense occurring at the same period over large areas; (*c*) the law of variation of volume; changes of volume of ice, as distinct from changes of form. The law of simultaneousness is found to hold good in boreal and arctic regions, but that of long-period variations seems inapplicable. In the Alps glaciers appear to advance or retreat uninterruptedly for ten, fifteen, or twenty

years, but in high latitudes it seems that, while variations of the first order continue for a long period of time, they may be modified or reversed by secondary variations during that time. Seasonal variations are of a different type to that observed, for example, in the Rhone glacier. The law of variation of volume is, *apparently* at least, not valid in high latitudes, as, for example, in the case of the Booming glacier, which Garwood showed to be advancing at a time when the quantity of ice in the upper part of its basin was diminishing. In a final section, M. Rabot compares the glacial variations during the nineteenth century with the variations of climate deduced from meteorological records by Ekholm and Willaume-Jantzen, but the results are not very conclusive.

REVIEWS.

AFRICA.

A Great Saharan Journey.*

The preponderating interest in the Central and Western Sahara possessed by France since her establishment in Algeria has hitherto been scarcely matched by the share contributed by French travellers to the literature of that region, at least so far as great records of exploration are concerned. France has for so long devoted her efforts to the opening of communication with the south by a long-neglected route, that her pioneers have been at a disadvantage as compared with the travellers who, from Tripoli as a base, have followed the more frequented caravan roads. That we are at last presented, in the work now before us, with the narrative of a successful trans-Saharan journey by the direct southern road from Algeria, is due to the indomitable perseverance of the man who, for more than sixteen years, devoted his whole energies to the opening of such a road. M. Foureau has during this time been so continuously at work in the field, that he has found little time to engage in literary labours; but now that his work is done, we are at last presented with a worthy record of the last and greatest achievement—the journey from Algeria to the Congo by way of Lake Chad.

M. Foureau's book is intended for the general public, and does not, therefore, enter into a discussion of the scientific results of the journey, which will form the subject of a separate publication. It supplies, in the form of a daily journal, a full account of the events of the march, interspersed with abundant details on the nature of the country, the character of its inhabitants, their mode of life, political and commercial relations, and so forth; combining the freshness of a personal narrative with a large amount of new information on some of the least known regions of the Sahara. An excellent idea is given, both by the descriptions and illustrations, of the unusual forms of surface due to the special types of denudation at work in the desert. Such are the Agharghar escarpment, likened by the traveller to the wall of a town of giants, with towers, pinnacles, and other structures rising above it, of which an illustration appears on p. 83; the granite "gur" of Anahef, formed of vast rounded blocks absolutely barren and desolate, which give a characteristic aspect to the whole district; the piles of sandstone rock, often of fantastic forms, which rise here and there above the level plain, and of which a remarkable example is shown on p. 131; while true mountain peaks of a more normal contour likewise exist in many parts. While supplying a new proof of the varied relief of the desert, the journey has, if anything, served to heighten the

* 'De L'Alger au Congo par le Tchad.' Par F. Foureau. Paris: Masson. 1902.

idea of inexorable barrenness which we are accustomed to associate with that appellation. Even in Air, M. Foureau found that desert conditions prevailed, for during his long halt at Agadez he was able to establish the fact that that country has no regular rainy season, but that the occasional storms merely cause irregular and local downpours. In Kanem, the same aridity was again *en évidence* in the immediate neighbourhood of Lake Chad, though before this an improvement of conditions had been observed. Of the scanty population of the desert, as well as of the more important agglomerations collected at such centres as Agadez and Zinder, we likewise learn much that is interesting. Those old bugbears of explorers, the Tuareg, were found to deserve no better character than has been hitherto ascribed to them, and more than once the traveller expresses the opinion that no reliance can be placed on their good faith, the friends of one day becoming the assassins of the next. Of the great admixture of blood in the more southern representatives of the race many indications were noticed, some of the men being entirely black, though without the typical negro features. Among the women a pure negro element was fairly common, including representatives of the most diverse stocks. An interesting instance of yearly tribal migrations is given in the northward and southward movements of the Kel Ui between Air and Damerghu, which, though combined with trading operations, is much more than a mere caravan march. Of the possibilities which lie before the regions traversed, M. Foureau speaks briefly in a final chapter. He urges the importance of studying the mineral resources of the Sahara, as these alone can furnish a product of value. Meanwhile efforts should be made to introduce French manufactures, for which purpose the establishment of a regular caravan service is of importance. The necessary security will be easily obtained through the domination, from Zinder, of Damerghu, on which Air depends almost entirely for its food supplies. A trans-Saharan railway, though commercially it could promise little return for the outlay, is regarded as of importance from an imperial point of view.

Nothing has yet been said of the part of the book dealing with the regions of Lake Chad and the Shari—not that this is by any means an unimportant section, but M. Foureau's work has lain so long in the Sahara, which has been *par excellence* the scene of his triumphs as a pioneer, that the chief interest of the work is naturally engrossed by the earlier and more extensive portion. Nor has anything been said of the incessant hardships and dangers entailed by the journey, though the extent of these can be fully judged from the unvarnished narrative of the explorer. Some idea of the difficulties to be overcome is given by the fact that out of the thousand camels with which the caravan set out from Wargla, but two survived to reach the southern borders of Air.

An Englishman in the Lake Rudolf Region.*

The account presented to the Society in 1900 by the late Captain Wellby on his journey in the regions south of Abyssinia was necessarily confined to a brief outline, and the full narrative of the journey, published since its author's regretted death in South Africa, will therefore be welcomed by all students of African geography. The book is remarkable for the straightforward simplicity of its style, which suits well with the personal nature of the narrative, and occasionally recalls the simple but effective narratives of the early days of travel. As regards its external form, the book suffers somewhat from the use of one of the heavy

* ''Twixt Sirdar and Menelik.' By the late Captain M. S. Wellby. London and New York: Harper. 1901.

papers so much in vogue at the present day, but for this the author can hardly have been responsible.

The early portion of the book deals with matters purely Abyssinian, but though lacking the geographical interest of the later parts, is useful as giving a vivid picture of Abyssinian life and the present political and military organization of the empire, as to which not much has yet been written in English. As is well known, Captain Wellby was an enthusiastic admirer of Menelik, and his verdict regarding the Abyssinians as a whole is decidedly favourable. From the point of view of novelty, the interest heightens with the plunge into the obscurely known regions south of the Hawash, and is maintained throughout the journey by the east and south of Lake Rudolf, and across the unknown interval between the lake and the Sobat. We are sometimes tempted to wish for fuller descriptions of the physical features of the country, especially in such regions as the fairyland of lake and mountain west of Lake Abai, or the water-parting between Rudolf and the Nile. Here the traveller was in entirely new ground, as is well shown in the surprising friendliness, with few exceptions, of the native tribes, and the unwonted tameness of the wild animals—elephants, giraffes, etc., allowing the traveller to approach quite near without showing the least timidity. It is pleasant to find that in these cases Captain Wellby resisted the temptation of a shot, except when food was really needed by his men. Physically this country seems to consist of arid plains traversed by dry watercourses, with occasional ranges of mountains. The search for water was an ever-present accompaniment of the daily marches, but though on one occasion the caravan was in some danger through failing to find a supply, it is said to be generally present at a slight depth below the surface. The natives fully appreciate the value of water in this parched land, and Captain Wellby thinks that they must at times suffer severely from its want.

As regards the tribes of the country passed through, and their mutual affinities, ethnologists will be somewhat tantalized by the absence of more definite information, which, however, is not to be wondered at if we remember that the expedition had no interpreter during the passage of the caravan through the country of the Turkana, Tamata, Boma, and other tribes west of Rudolf, intercourse being carried on largely by means of signs. That Captain Wellby succeeded as he did in passing through the territory of so many different races almost without a hostile encounter says much for his tact and sympathetic attitude in his intercourse with the natives—qualities for which he deserves to rank high in the roll of African explorers.

Morocco.*

Of the three separate volumes which, though each is complete in itself, are to make up the monumental monograph on Morocco to which Mr. Meakin has devoted years of persevering research, the second is the one with which we are more particularly concerned, as dealing with the geography of the country as at present known. The first volume of the series, which appeared some two years ago, formed the most complete history yet written of the internal development of the Moorish empire and its relations with the outside world; while the third, the appearance of which is promised at an early date, will deal very completely with the social and religious life of the people, and the different ethnological types present in the country. Mr. Meakin writes in a forcible and unconventional style, and as he has been at immense pains to make his information as complete as possible, both by

* 'The Land of the Moors: A Comprehensive Description.' By Budgett Meakin. London: Sonnenschein. 1901.

personal travel and a study of all existing literature on the subject, his work is likely long to remain the standard authority on Morocco under its various aspects.

In writing his second volume, Mr. Meakin has been somewhat at a disadvantage, as he himself explains, through the incompleteness of the material yet existing on the geography of the Moroccan empire. In spite of the labours of recent travellers, a large amount of its surface remains untrodden by the European, and the gaps in our knowledge are such as to preclude the possibility of exhaustive treatment. This is well shown by the excellent map, in which all the principal routes of travellers are laid down, and which brings out in a marked way the large areas, especially in the Atlas, which remain quite unsurveyed. Mr. Meakin is, moreover, first and foremost a historian, and a minute study of the physical geography, to which only the opening chapter is devoted, was hardly to be expected from him. So far as it goes, the sketch of the broad surface features of Morocco is clear and instructive. It is followed by useful chapters on the mineral, vegetable, and animal products of the country, while the bulk of the book is occupied with detailed descriptions of the principal ports (open or closed), the three imperial cities, and Spanish possessions. Here the author is at his best, his wide knowledge of Moroccan history enabling him to trace the fortunes of the places described throughout their chequered history, while the antiquarian and other objects of interest in or near them are fully treated of. A sketch of the little-known regions beyond the Atlas follows, while the last part of the book is devoted to personal reminiscences of travel, some of them referring to experiences when, in Moorish guise, the author mixed on equal terms with the native inhabitants, passing without difficulty for one of their number.

The system employed of writing Moorish names, to which the author has devoted much attention, is on the whole satisfactory, though it could be wished that the double English vowels (*ee*, *oo*) had been more consistently discarded. The introduction of such forms as "Idreesi" seems certainly to be deprecated. Taken as a whole, the book is a veritable storehouse of information, and gives clear indications of the vast amount of labour devoted to its preparation.

Southern Sierra Leone.*

Amid the multitude of books of travel which are based on a mere rapid passage through the region described, it is refreshing to light now and then upon one whose author has qualified himself by long residence and careful observation to supply a more solid fare to the student, even though his narrative may lack the sensational incidents of a great exploring journey. Such is the volume recently given to the public by Mr. T. J. Alldridge, who for over ten years has been a public officer in the Sierra Leone Protectorate, and has taken every opportunity during his journeys through its least known districts, as well as when residing on the coast, to make himself acquainted with the geography and natural resources of the territory and to study the customs of its inhabitants. The work is all the more welcome from the fact that, though Sierra Leone is one of the oldest British possessions in Africa, we have hitherto been entirely without a comprehensive and authoritative description of the country and its people. For the southern portion at least, the want is in great measure supplied by Mr. Alldridge's volume.

Sherbro island and a narrow strip of the adjacent mainland form a part of the Crown colony of Sierra Leone, while the hinterland of which the Sherbro district

* 'The Sherbro and its Hinterland.' By T. J. Alldridge, F.R.G.S. London: Macmillan. 1901.

proper, with its seat of government at Bonthe, is the trading centre, comprises the southernmost district (with parts of two others) of the five into which the Sierra Leone Protectorate has lately been divided. This hinterland, of the great natural wealth of which Mr. Alldridge gives a glowing description, is at present approached by the numerous streams which enter the so-called Sherbro river; and as this forms a shipping port available all the year round, its great natural advantages are obvious, though the opening up of trade routes with proper facilities for transport into the remoter parts of the interior is of paramount importance for the further development of the country. Since 1890 a vast improvement has been effected in the general condition of the territory, and the steps by which this has been brought about form the theme of a considerable part of the volume. Mr. Alldridge at least has no doubt as to the blessings which have accrued to the people through British rule, and the sentimental outcry sometimes raised against an interference with the native *régime* finds little support in his pages. In discussing the potentialities of the country, he augurs well from the readiness with which the people—first-rate soldiers—take service under the British authorities, and the abundant labour-supply available when there is a prospect of its being fairly paid for; laying stress also on the unfailing crops derived from the oil-palm, the still undeveloped rubber-supply, and the promise offered by cultivated products, especially coffee.

To ethnologists the most important part of the book will be the notes on native customs, which occupy several chapters, and include a full description of the various secret societies among the people, to the study of which the author has devoted much time and attention. An excellent large-scale map, first published by the Intelligence Division of the War Office in 1898, accompanies the volume.

The Masai Race.*

That the Masai race of East Africa is doomed to speedy extinction before the advance of European civilization, is an opinion expressed by more than one traveller who has given attention to the subject. And although the experience of the last few years has led to the modification of this opinion, owing to the unexpected way in which the race has shown itself capable of adaptation to altered conditions, there is no doubt that with the breaking down of the old isolation in which the Masai lived until quite recent years, both the purity of blood and the national life and customs of this interesting race will very soon be things of the past. On this account the work now before us possesses a special value as helping to rescue from oblivion a large mass of ethnological material, which the almost unique character of the Masai among African peoples renders of special interest. Considering the nature of the means at his disposal, the late Joseph Thomson gave to students a surprisingly clear picture of the inner life of the race, but since his day no traveller has up till now succeeded in adding appreciably to his information by personal intercourse with the Masai, owing to the retiring nature which, strange to say, is one of the chief characteristics of this warlike people when not actually engaged in fighting. Mr. and Mrs. Hinde have, however, enjoyed special facilities for research, the former by reason of his official connection with the Masai, the latter through her linguistic gifts, which have enabled her to hold intercourse with the people in their own language, and of these facilities good use has been made.

* 'The Last of the Masai.' By Sidney Langford Hinde and Hildegarde Hinde. London: Heinemann. 1901.

The book opens with a general sketch of the race and its internal organization, afterwards touching in turn upon the characteristics, mental and physical, of the Masai, their customs, employments, religion, superstitions, laws, and so forth. In the first chapter we miss a full discussion of the position occupied by the Masai in the family tree of African peoples, for, after dismissing the idea of an affinity with the Zulus, the authors content themselves with the statement that probably the race is intrusive from the north. An interesting section is that which deals with the recent history of the race and the fortunes of its royal family, divided of late into two hostile factions under Lenana and Sendego, sons of the old chief Batian. The collection of this detailed information must have been a work involving much trouble and perseverance. The information presented on the life of the people shows them in a favourable light from many points of view, and the general conclusion arrived at is that the Masai are unquestionably of far greater interest than most African peoples, and that the destruction of so virile a race would be a permanent loss to East Africa. The book concludes with interesting notes on the game of East Africa, in which Mr. Hinde, though no enemy to legitimate sport, speaks out, we are glad to see, against the destruction so often indulged in from pure lust for slaughter. Many of the wild animals might, he thinks, be acclimatized in this country.

THE FIRST MAP CONTAINING THE NAME AMERICA.

By BASIL H. SOULSBY, Assistant in the Map Room, British Museum, and Hon. Secretary to the Hakluyt Society.

On April 25 (*i.e.* vii. Kl Maii), 1507, there was published at the insignificant town of St. Dié, in the Vosges mountains, a small geographical treatise which has left its mark upon the world for all time. For in this little book it was first suggested that the then lately discovered fourth part of the world should be called "America, because Americus [Vespucius] discovered it." The book in question, entitled 'Cosmographiæ Introductio,' was the first production of the printing press which had only just before been erected in the town. The work itself was projected and published under the auspices of the Gymnase Vosgien, a society for the cultivation of the arts and sciences, which had been established at St. Dié by Gualtier Lud about 1490, under the patronage of René, the reigning Duke of Lorraine.

Amongst the members of the Gymnase, at the commencement of the sixteenth century, were three who were more especially associated in the study of geography, and in the issue of the 'Cosmographiæ Introductio'—Nicholas Lud, Mathias Ringman, and Martin Waldseemüller. Our immediate interest centres in the last named, for he was the professed geographer and cartographer of the coterie.

The 'Cosmographiæ Introductio' purports to contain some principles of geometry and astronomy necessary to the understanding of the subject; also an account of the four voyages of Americus Vespucius. Furthermore, the title makes mention of "a representation of universal cosmography both *in solido* and *in plano* (*tam in solido qz*

plano) on which were inserted "what to Ptolemy was unknown and lately discovered." From the detailed description of the globe (*solidum*) and map *in plano*, given on the back of a folding diagram in the book, it has generally been supposed they were to be too large for actual insertion in the volume itself as folded plates, but that the descriptive text was intended to accompany a separate map and globe as a sort of explanatory handbook. Experts have differed in their ideas as to the interpretation of the word *solidum*, some holding a solid or hollow hand-drawn or painted globe was meant, or possibly printed gores intended to be cut up and mounted on to a solid or hollow globe of the requisite size; while others have suggested that the term may have denoted an attempted representation of the globular shape of the world on a flat surface in contradistinction to an extended view on the customary conical plane projections of the period.

From the above-mentioned description on the plan, and from other passages in the book, we learn that the map and globe were to contain representations of the newly discovered fourth part of the world. No particulars of size are given, save the statement that, while in the globe space has been very restricted, there was more room on the map. It is further explained that, while the map followed Ptolemy's manner for the most part, the globe "conformed to the subjoined description of Americus."

It has long been contended that if this map and globe ever came to light, the newly discovered western lands represented thereon would probably be found to bear the name AMERICA, as suggested in the book. This contention was made almost a certainty when the two manuscript maps by Glareanus were discovered at Munich and Bonn by Dr. Wieser and Prof. Elter respectively, for both these maps bear the name America. The Bonn map is dated 1510, and in a legend written thereon, Glareanus himself, although he does not mention Waldseemüller, tells us distinctly that he has followed "the Deodatensian [St. Dié] or preferably Vosgean geographer."

Ever since Humboldt first called attention to the 'Cosmographiæ Introductio,' no lost maps have ever been sought for so diligently as these of Waldseemüller. It is not too much to say that the honour of being their lucky discoverer has long been considered as the highest possible prize to be obtained amongst students in the field of ancient cartography. But until the last few months, although many copies of the book are known in various editions, no specimen of either the globe or map has ever been seen or heard of in modern times. Some historians and geographers have even gone so far as to state definitely that they were never issued at all, and the book published alone. Others have held that they never got beyond their manuscript form, while some have contended that they were actually issued with the book, but, being separate, had become lost in the course of time. The writers

holding the last view have been brought to their belief by tracing what may be termed the influence of the St. Dié cartography in later maps, and they have proved to be right, for a few months ago the geographical world was suddenly startled by a brief announcement that Waldseemüller's long-lost map of 1507, together with another of his of 1516, had been discovered by Prof. P. Joseph Fischer of Feldkirch, in the library of Prince Waldburg at Wolfegg Castle, in Wurttemberg. On this happy discovery we most heartily congratulate him. Geographical students in all parts of the world have awaited with the deepest interest details of this most important discovery, but no one was probably prepared for the gigantic cartographical monster which Prof. Fischer has now awakened from so many centuries of peaceful slumber in a German castle.

In *Petermanns Mitteilungen* for December last (pp. 271–275) Prof. Dr. Fr. R. v. Wieser gives a most interesting and lucid account of the maps discovered by Prof. Fischer, in an article entitled "The oldest map with the name America of the year 1507 and the Carta Marina of the year 1516 of Martin Waldseemüller," to which the reader is referred. But for the sake of the subjoined arguments, a few particulars are extracted or gathered from Dr. Wieser's valuable paper.

The article opens with a brief sketch of Waldseemüller, who Dr. Wieser hopes may deservedly be more highly rated among scientific men in future now that his important geographical work has become known. Dr. Wieser points out that his three large maps, hitherto known only by description or by reduced copies, have at length all been unearthed, viz. the map of the world of 1507, the *Carta itineraria Europæ* of 1511, and the *Carta marina* of 1516. The second of these had already been discovered by Dr. Wieser himself at Munich in 1893, while the first and third are the recent discovery of Prof. Fischer, his former pupil. The professor was engaged on a scientific work on the discoveries of the Norsemen in Greenland and on the north-east coast of North America, and was pursuing his researches for old maps of those parts in the valuable library of Prince Waldburg at Wolfegg, in Wurttemberg, when, in one of the folio volumes of the print department, he came across the two maps of the world by Waldseemüller. Both maps are wood engravings, and each consists of twelve folio sheets. If we understand the description aright, each map, if put together, would be four sheets wide by three sheets high. Each sheet measures 45·5 centimetres high by 62 centimetres long, so that approximately each map, if made up, would measure about 8 feet wide by 4 feet 6 inches high—a large map even at the present day. The sheets of the maps have been folded once and bound in elephant folio. Inside the front cover has been pasted the well-known book-plate of Johannes Schöner. To the fact of the Wolfegg copies being so bound we owe their survival. The enormous size when made up as wall-maps no doubt accounts for

their general disappearance, notwithstanding that from a legend on the 1516 map we learn that no less than a thousand copies were printed. It is supposed, from the appearance of the Wolfegg copies, that they are proof-sheets, or "pull-offs."

The map of 1507 is drawn on the modified cone projection of Ptolemy with curved meridians. At the bottom is the inscription in capital letters: "*Universalis Cosmographia secundum Ptholomæi traditionem et Americi Vespucii aliorumque lustrationes.*" The author's name is not given anywhere, nor is there any date or imprint, but an expert will not have the slightest hesitation in affirming this copy to be the long-lost map of the world by Waldseemüller of 1507. Its identity can be proved to the fullest degree, particularly by four weighty arguments: (1) the agreement with the reduced manuscript maps of Glareanus made from the map of Waldseemüller; (2) the agreement with all references in the 'Cosmographiæ Introductio;' (3) the literal agreement of numerous legends on the map with passages in the book; (4) the agreement in form and arrangement with the 1516 map in the same Wolfegg volume, which is especially described thereon as the work of Waldseemüller. The following passage should be particularly noted, as it is desired to comment thereon in our subsequent remarks:—

"The map of the world of 1507 has a peculiar interest in that it represents the new transatlantic discoveries. It must be noted that we are dealing with the earliest printed map showing these discoveries, and also the earliest map in which the name of America is given to the New World. Waldseemüller, as he proposed in the 'Cosmographiæ Introductio,' has given this name to the southern continent of the New World. Immediately over the Tropic of Capricorn there is to be read here, for the first time, the word 'America,' later on to attain such importance."

To continue Dr. Wieser's description in general. The polar bight of the network of degrees is filled in with two inset maps representing the old world and the new. Next to them are placed two busts, drawn with true artistic fire, Ptolemy on one side, and Amerigo Vespucci on the other. These two plane globes are the very two maps, the subject of so much discussion, which appear in Johann de Stobnicza's 'Introductio in Ptholomei Cosmographiam' (Cracow, 1512). This clears up the mystery as to the source whence the Pole himself slavishly copied his two hemispheres. Now we need no longer wonder why Glareanus drew his western hemisphere exactly like Stobnicza, for his two maps can also be traced back to the same original. An examination of the large map of 1507 with its two insets will at once remind the reader of the statement already referred to, that the map was to be both *in solido* and *in plano*. Dr. Wieser is almost driven to the conclusion that the phrase *in solido* refers to the two small inset hemispheres, with which conclusion we concur. The various interpretations of *solido* have already been discussed.

Dr. Wieser then gives an equally interesting account of the 1516 *Carta Marina*, to which the reader is referred, as space prohibits dealing with it in the present article, since it is desired to comment on what is claimed for the 1507 map. The only point about the 1516 map that need be mentioned here is that it omits the name America, which Dr. Wieser explains as follows: "From the narratives of voyages accessible since 1507 Waldseemüller had learnt that Amerigo Vespucci was not, as he had hitherto thought, the first discoverer of the New World. Consequently he made no further use of the name which he himself had proposed for the new continent." In conclusion, Dr. Wieser states that both the maps are to be made accessible to students by exact reproductions in facsimile, to be edited by Prof. Fischer and himself.

We agree in the main with the opinions and deductions expressed by Dr. Wieser in regard to the maps and their history. But without in the slightest degree desiring to challenge the great historical and geographical importance of Prof. Fischer's great discovery, there are two points against which it is necessary to enter a friendly caveat. These points are the stated first representation in print of the New World discoveries, and the first use of the name America on the Wolfegg map of 1507.

In face of the definite fact that the name of America for the new continent was first suggested in the *Cosmographiæ Introductio*, published at St. Dié in April, 1507, and of the further fact that the name has now also been found on the newly discovered map made to accompany that book, he would appear to be a bold man who attempted to assert and prove that the name America could by any possibility have appeared on an earlier map. Yet such a claim is seriously made, and a large amount of *primâ facie* evidence exhibited in support of it.

Some five or six years ago, Mr. Henry N. Stevens, of Great Russell Street, London (son of the late Henry Stevens of Vermont, an acknowledged authority on all matters connected with American history and cartography), discovered, inserted in an imperfect copy of the Strasburg Ptolemy of 1513, a map of the world entirely different to the one usually found in the supplement of that work. This map had all the appearance of being the prototype of the usual one, although it bore the name America. Mr. Stevens, following in the footsteps of his father, has had considerable experience in early maps and globes relating to America, by reason of the numerous cartographical rarities which have passed through his hands in the way of business. He devoted much of his spare time to the study of his America map, but it was not for some years that he was able to bring his investigations to anything like a satisfactory issue. But by the autumn of 1900 he was in a position to suggest that his map was the work of Waldseemüller, and of a date prior to the first issue of the 'Cosmographiæ Introductio.' As such, it was believed to be the earliest

printed map that had yet been discovered, showing any part of the New World discoveries or to bear the name America. A brief report was prepared and the map offered for sale to an American library, perhaps one of the richest in "corner-stones of American history." Mr. Stevens was told that before the purchase could for one moment be entertained, the strictest investigation must take place by an independent American expert, who would be instructed to enter on his task with an adverse mind. The expert promptly called for further detailed information on certain specified points. Throwing all business aside for nearly three months, Mr. Stevens went thoroughly into the whole matter afresh, and finally drew up and submitted a fresh report in the shape of an historical essay extending to over 200 closely written folio pages. After considerable time he was informed that it was considered he had fully made out his case, and the purchase for the American library was finally concluded in May, 1901. All this is mentioned in order to show that Mr. Stevens's arguments have already stood one exceptionally severe test. His report was returned to him with critical notes and suggestions for revision, which mostly tended to strengthen the arguments in support of his contentions. Mr. Stevens, having accordingly revised his essay at his leisure during the summer of 1901, was on the point of sending it to press for publication, when the first announcement of Prof. Fischer's important discovery was made. He immediately decided to withhold the manuscript from the press until it was ascertained how far the newly discovered maps would affect his arguments. It was not till the appearance of Dr. Wieser's article that sufficient details were obtainable to afford Mr. Stevens the opportunity of forming a preliminary opinion, prior to examining the maps themselves.

It now appears that the maps discovered by Prof. Fischer and by Mr. Stevens are entirely different, and yet both presumably the work of Waldseemüller. Mr. Stevens still believes his to be the earlier, but until he has seen the Wolfegg maps and made a critical examination of the internal evidence of their geographical configurations and nomenclature, he prefers not to express an absolutely positive opinion. Yet the evidence he produces is certainly strong.

In order that independent testimony may be forthcoming in case of need, as to the evidence collected by Mr. Stevens prior to the discovery of the Wolfegg maps, he has placed his essay in the hands of the writer and his colleague, Mr. G. F. Barwick, assistant keeper of Printed Books in the British Museum.

Summed up as briefly as possible, Mr. Stevens's arguments appear to show, in the first place, conclusively that his map was the prototype of the 1513 Ptolemy new map of the world, and not *vice versâ*. Consequent on that proof, he immediately arrives at the definite fact that a map bearing the name America proved to be prior to 1513 must of necessity

be the earliest yet discovered, because (until the discovery of the Wolfegg 1507 map) no other printed map or globe bearing the name America is definitely known to be earlier than 1513. Mr. Stevens accounts for the disappearance of the name America from the 1513 Ptolemy map by a precisely similar argument to that exhibited by Dr. Wieser in accounting for the elimination of the name from the 1516 Wolfegg map.

Working backwards, Mr. Stevens, by skilful analysis, carries the date of his map back to 1506-7—that is to say, to a time prior to the publication of the 'Cosmographiæ Introductio' in April, 1507. He exhibits his authorities as he goes along for every definite statement made or conjecture offered. The argument is certainly most plausible, for he divides his analysis into seven or more distinct headings. Thus he examines the map from the separate points of view of the engraving, the typography, the paper, the geographical configurations, the nomenclature, the existing historical evidence prior to the publication of the 'Cosmographiæ Introductio,' and the historical evidence subsequent to the publication of that important work. Every one of these arguments focuses back to the date of 1506-7 with more or less appearance of certainty and probability. In the more obscure cases the doctrine of accumulative probabilities undoubtedly adds weight to the cases where the evidence is more conclusive and definite.

On the other hand, neither Mr. Stevens nor the American expert was able to trace any evidence tending to show that the map was later than the publication of the 'Cosmographiæ Introductio.'

Reversing the argument and working forward, Mr. Stevens shows in detail that a new edition of Ptolemy, proposed to be issued at St. Dié, was projected as far back as 1505, and that early in 1507 we have evidence that the work was about to be printed at St. Dié with Ptolemy's maps revised and some new ones added. It seems extremely probable that the new map of the world would have been the very first to have been undertaken before any of the special maps. Definite evidence exists that two separate maps or globes showing the New World discoveries were drawn, if not printed, prior to the map and globe issued with the 'Cosmographiæ Introductio.' It is believed that Mr. Stevens's prototype of the 1513 Ptolemy map is one of the two referred to. Nobody could say for certain that the large map of the 'Cosmographiæ Introductio' was ever printed until the Wolfegg specimen turned up. It was, therefore, quite as probable that the earlier map was also printed and also lost. We know that the new edition of Ptolemy was for some reason abandoned, but afterwards "awakened from a six years' slumber" and completed by other editors at Strasburg in 1513. The same reasons that caused the Ptolemy to be abandoned may have thrown the map into disuse, for when the work came to be issued in 1513 this map was re-engraved in quite a different

manner. It is probable the earlier map was never actually published, and that Mr. Stevens's specimen may have only been a proof impression.

Considering the enormous size of the newly discovered Wolfegg map of 1507, it cannot for one moment be supposed that Waldseemüller drew so large a map as a first effort. Much more likely that he first prepared a map of reasonable size, perhaps just such as we find in the 1513 Ptolemy. This size is about as large as existing presses could print. Very definite reasons are exhibited for believing that just such a map actually was made, but it would not be fair to Mr. Stevens to reveal all the points of his arguments, as he proposes to publish his essay as soon as he is enabled to revise it by any new deductions to be drawn from the Wolfegg maps. But a very strong *primâ facie* case seems to be made out for entering a friendly caveat against the claim of the Wolfegg map of 1507 to be the first to show the western discoveries, and the first to bear the name America.

After all, the fact of there being an earlier map than that of the 'Cosmographiæ Introductio,' showing the New World discoveries and bearing the name America before that name was first suggested *in print*, is by no means so paradoxical as at first sight appears. We know that the members of the St. Dié *Gymnase* were thorough believers in Vespucius, for had not Ringman edited and printed at Strasburg as early as 1505 the Vespucian tract, 'De ora antarctica'? The reprinting of the four voyages of Vespucius as a supplement to the 'Cosmographiæ Introductio;' the frequent mention of him in the work itself; the fact of his portrait appearing on the newly discovered Wolfegg maps, all tend to prove the Vespucian tendencies of Waldseemüller and his associates. It is, therefore, absurd to suppose that the suggestion of the name of America for the New World only materialized at the very moment when the book containing that suggestion was first published. It is perfectly feasible and reasonable to suppose that the idea may have occurred to them at any time between 1505 and 1507, but was only made public when it first appeared in print. It is also quite within the bounds of possibility that it may even have been intended to make the suggestion in the new edition of Ptolemy, which we know was in preparation prior to the 'Cosmographiæ Introductio,' but never completed at St. Dié. Mr. Stevens thinks it quite possible that the matter in the Cosmographiæ Introductio' may even have been the new matter originally intended for the new edition of Ptolemy. This would account for the sudden abandoning of the Ptolemy and the issue of the 'Cosmographiæ Introductio' in its place. If this suggestion as to the new edition of Ptolemy has any force, it would also account for the name America being found on a map which is undoubtedly the prototype of the world map in the edition of Ptolemy of 1513, which the editors tell us was originally commenced amidst the crags of the Vosges mountains (*i.e.* St. Dié) six years before. It is to be hoped Mr. Stevens may deduce

some further evidence on this point from an examination of the Wolfegg maps.

Meanwhile, the very size of the Wolfegg 1507 map points clearly to the theory of an earlier map, showing the western discoveries and bearing the word America; for the work of drawing, engraving, and printing a thousand maps of twelve large sheets must have taken a very considerable time, not to mention the printing of the book. All this time the name America must have been in the minds of Waldseemüller and his associates, for before the book was printed it must have been written, and before the large map was printed it had to be engraved, before it was engraved it had to be drawn, before it was drawn it had to be thought out, and it was professedly prepared on Vespucian information. Thus the name of Americus Vespucius must have been constantly before them for at least many months prior to the publication of their large map and accompanying book.

We shall look forward with much interest to the appearance of the promised facsimiles of the Wolfegg maps, and the further descriptive matter by the joint editors, Dr. Wieser and Prof. Fischer. Considerable interest will no doubt also be aroused by Mr. Stevens's book, and we anticipate that the rival claims to the first use of the name America, and the first representation in print of the New World discoveries, will tend to the advancement of knowledge, by causing the whole subject to be thoroughly reinvestigated.

If Mr. Stevens is not able to establish the priority of his map, the interesting point will then have to be decided as to when and where and under what circumstances it came to be produced *after* the publication of the 'Cosmographiæ Introductio,' for at present no evidence whatever seems to be forthcoming on that point. The suggestion that the map is really the prototype of that in the 1513 Ptolemy, made when that work was in progress at St. Dié in 1506-7, is by no means without parallel, for Mr. Stevens has found a precisely similar circumstance with regard to the Ulm Ptolemy of 1482. When examining last summer a copy of that work which contained some curious variations not yet found in any other copy, although more than twenty have already been examined, he discovered that the world map was entirely different to the one usually found in either the 1482 or 1486 editions. This proved to be the prototype of the usual map, re-engraved probably for the alterations in the East Indies. It may possibly turn out to be the very earliest printed map of the world drawn on modern geographical conceptions.

THE MONTHLY RECORD.

EUROPE.

The Neckar Canal.—The question of the dredging and canalization of the Neckar from Esslingen to its junction with the Rhine at Mannheim, which has long been contemplated, has lately advanced a further stage. The committee appointed for the consideration of the project, after three years' investigation and full surveys, have issued a report, recommending the plan as practicable, and estimating the cost of construction at £2,000,000 to £2,500,000 sterling. It is calculated that the various locks would render an amount of water-power available which is valued at £1,300,000. The probable reduction in freights would amount to about 50 per cent. for the distance Mannheim to Heilbronn, and to about 30 per cent. from the latter place to Cannstadt. The Government is impressed with the importance of the project, and has submitted it to the consideration of the Baden Government, without whose co-operation the canal cannot be undertaken. The utilization of rivers as a means of cheap transport has of late become an important feature in Germany, and the carrying capacity of the river and canal-boats now surpasses that of the sea-going vessels by nearly one million tons. The cost of transport on German waterways has in consequence greatly diminished, and is now something less than one farthing per ton per mile.

Origin of the Valleys of the Western Alps.—Prof. Lugeon of Lausanne gives a long abstract of his memoir, which gained the Gay prize of the Institute of France in 1900, in the *Annales de Géographie* for July and November, 1901. All the great Alpine river-systems from the Enns in the east to the Drac in the west, can be divided into three parts: (1) the upper tributaries flowing at right angles to the axis of the range and parallel to each other into (2) the great longitudinal valleys, from which the rivers pass beyond the mountains by (3) transverse valleys at right angles to (2). The transverse valleys are not to be regarded as purely superimposed. In the early history of a chain the foldings were much less marked than they are at present, and the primitive surface possessed a fairly uniform relief revealing the general arrangement of the chain, *i.e.* roughly parallel to the present lines of greatest elevation. In it were many lakes filling the basins. These were joined by consequent streams which left the chain at right angles to its direction along the greatest slopes. As erosion progressed the number of these would diminish, and they would be separated by parallel ridges, which would approach the more closely to a stream the less it was incised if all the streams were uninfluenced by the underlying structure. This is not the case in the Alps, and it is necessary to suppose that the structural surface had a series of transverse depressions more or less distant from each other, whose length and depth would in the long run determine valleys more or less important, such as those which exist to-day. The greater part of the memoir is devoted to an examination of such transverse valleys. (*a*) The valleys are examined of the sub-Alpine regions, of the Bauges and Genevois, of Chartreuse and Grenoble, when the valleys cut across the fold normally or obliquely. The case of the Chéran (in the Bauges) may be cited as an example of the transverse valleys coinciding with a sinking in the axis of upfolding, and is illustrated by a reconstruction of the surface of the Lower Urgonian, supposing that no erosion had affected it, and that the overlying rock had been removed, as well as by sections and a sketch of the valley, which illustrates Prof. Lugeon's contention. The Bauges and the Genevois are structurally similar, but the folds of the Genevois preserve their Urgonian carapace, and are a great contrast to the Bauges, where as a rule this

has been removed, and the whole country has been subjected to much greater denudation owing to its having been 1000 to 1300 feet higher than the Genevois. Here is an excellent example of two phases of drainage in regions of similar structure, under practically identical climatic conditions, but the one more elevated and with steeper slopes to its base-level than the other, and therefore more completely eroded. This is not a case of older and younger, but of earlier and later phases in an erosion cycle, and illustrates the disadvantage of employing the terms old and young to characterize late and early phases of the erosion cycle. In the case of the transverse valley of the Isère from Grenoble to Moirans, after crossing synclinal parts of a series of anticlines and synclines, the river crosses the Echaillon upfold at a slightly upturned part of the fold. This the author explains as a case of superimposition. Another case, which Prof. Lugeon finds more difficult to explain, is that of the Chéran, where it flows across the Semnoz ridge, it is true almost at the minimum point of the anticlinal axis, instead of following the longitudinal valley of Leschaux. He inclines to explain it as a superimposed valley. (*b*) The valleys of Chablais and of the Arve are next studied. The lower Dranse crosses the anticlinal axis at downward inflexion, but higher up the valleys are superimposed on the mass of La Brèche, and the valleys of the Giffre and the Arve are also superimposed. Prof. Lugeon concludes that, speaking generally, the valleys bear no relationship to the foldings in regions where these are covered over or where the overthrust areas have not been subjected to internal foldings posterior to their displacement. (*c*) The valley of the Rhone, from Martigny to the Lake of Geneva, crosses the crystalline axis where it is narrowest, the sub-Alpine limestones where it is wider, but here it is bounded by almost vertical though lower walls, and the pre-Alps where it is wider and bounded by much gentler slopes. In this lower part the valley coincides with down-bendings of the anticlinal axis, but above Bex this is not the case, and the valley is superimposed. The second chapter of the memoir deals with the great longitudinal valleys, which the author regards as subsequent, helped either by structural conditions (synclinal valleys) or by the relative ease of erosion of certain outcrops (monoclinal valleys). Each of the great exterior transverse valleys is but a continuation of an interior transverse valley, *e.g.* Dranse de Bagnes-Rhone, Doron-Isère, Arc-Chéran, Allevard-Chambery depression. The longitudinal valleys of the Rhone and of the Arve are synclinal, or else monoclinal derived from the synclinal. The most remarkable illustration is the great depression of the Grésivaudan, along which the Isère flows. It is not purely synclinal, and the valley cuts the fold axes obliquely, and is superimposed. Prof. Lugeon points out how the rivers embedded in the Dogger and Lias were first superimposed by virtue of the primitive structural surface, abandoned their original directions, and by regressive erosion and glacial action formed the present region of longitudinal valleys above these rocks on the margin of the crystalline region.

The Height of Etna.—A note in the *Geographische Zeitschrift* states that during the geodetic measurements carried out in 1900 between Sicily and Malta, the present height of Etna was accurately determined and found to be 3279 metres (10,758 feet), as compared with 3313 metres (10,870 feet), the height which has hitherto been assigned to it. Like all active or partially active volcanoes, the height is of course liable to slight variations from accumulations of ejected matter. The greatest width of the crater was 17,290 feet, and its depth 827 feet.

Exploration of the Scutari Lake.—Soundings in the Scutari lake were first made by Austrian officers, and later by Prof. Kurt Hassert. Out of seventy soundings the greatest depth obtained was 7 metres (23 feet), and the data were included in the Austro-Hungarian map of Montenegro (scale 1 : 75,000). During the summer of 1901 Prof. Cvijč has had an opportunity of more fully exploring

this lake by means of 240 new soundings, with the following results. Close to the steep south-western margin are over a dozen deep holes of the kind found by André Delebecque in the Lac d'Annecy. The deepest of these, near the village of Raduš, attains a depth of 44 metres (144 feet). According to Austrian measurements, the surface of the lake is 6 metres (20 feet) above the sea, hence its deepest point is 38 metres (124 feet) below sea-level. Not only in these holes, but over the greater part of the bottom, the water of the lake is ground-water. As prediluvial (neogene) deposits are not found anywhere in the neighbourhood, it follows that the Scutari lake must first have come into existence in the diluvial period, and this leads to the conclusion that the bottom must have reached its maximum depression of 44 metres since that time. The Scutari lake is classified as a permanently inundated "Karstpolje." As Cvijič has observed, a whole series of such "Karstpoljen" indicates a diluvial subsidence in the south-west or Adriatic region, as part of the morphological history of Southern Europe.

French Scientific Expedition in Crete.—An important expedition for the study of the geology and physical geography of Crete left France early in 1901, under MM. Ardaillon and Cayeux, the former professor of geography at the University of Lille, the latter a member of the staff of the "École des Mines." A preliminary account of the work of the first five months was given in the *Annales de Géographie* for November last. On the way out the travellers paid a visit to Attica and Argolis, and were successful in re-discovering the fossiliferous strata described by the Morea Expedition, but of which the very existence has since been denied. They also made an interesting study of the changes in the coast-line and the age of the plain of Argos. In Crete the part chosen as the first sphere of operations was the western quarter of the island, the geology of which was all but unknown, the strata being reported to be without fossils. Many fossiliferous deposits were, however, discovered, and the result was to show that from the Permian to the Pliocene the series of formations is complete, apart from a vast gap from the Lower Jurassic to the Lower Cretaceous. The attempt to decipher the tectonic relations between Crete and the Peloponnesus proved beset with difficulties, and no definite hypothesis can yet be put forward. It seems probable, however, that the Grabusa peninsula is the continuance of that of Messenia, while that of Spada is the representative of Taygetus. The interior mountains are composed of folds running from south-west to north-east, not, as seems at first sight, from west to east. The present topographic forms have also been fully studied in their relation to the structure and the nature of the soil, while topographic surveys have been made as well as investigations as to the displacement of the coast-line during the historic era, in regard to which the conclusions of Captain Spratt are said to have proved ill-founded.

ASIA.

Artesian Possibilities in India.—The question of a possible extension of a system of artesian borings in India is discussed by Mr. Vredenburg, of the Geological Survey of India, in the *Memoirs* of that department (vol. 32, part 2). The larger part of the paper deals with recent experiments in various districts, but the introductory section supplies a valuable review of the subject of artesian water-supply in general, with a clear statement of the true scope and the limitations of this method. After pointing out that artesian resources are of special value in deserts, as rendering possible a limited amount of cultivation in districts that must otherwise be entirely barren, the author shows their comparative inefficiency in more humid regions, where any possible artesian supply must bear a very small proportion to that derived in normal years from the local rainfall. It is in the regions

where the rainfall in ordinary years is just sufficient for the needs of agriculture, that a store to be drawn upon in exceptional years is most needed if famine in India is to be prevented in future. Such a store, however, cannot be supplied by artesian borings, even in the districts most favourably placed by the nature of the geological formations. In India there nowhere exist conditions so favourable as those found in many parts of the United States, and even here the limited capabilities of artesian supplies have been insisted on by so competent an authority as Major Powell, who has stated that "if all the artesian wells in the world that are used for irrigation were assembled in one county of Dakota, they would not irrigate that county." More is to be expected in India from an extension of the system of wells supplied by "ground-water;" but it is to the development of the tank and canal system that the country must look for future prevention of famines. Although unimportant from the point of view of irrigation, artesian reservoirs may still be of great use for other important purposes, such as for manufacturing or for a drinking-water supply. Certainly India possesses no such reservoir comparable to the Dakota sandstone of North America, but the geological features are still too imperfectly known to permit a verdict as to the possibilities from this point of view. The "Deccan trap," "Vindhyan," and the alluvial formations of the Gangetic plain are mentioned as special fields for examination as regards artesian supply. Comparatively little has been done since the question was reviewed by Mr. Medlicott in 1881, and of the experiments described in the second part of the paper those at Quetta have so far given the most successful results.

Railways in India, 1900.—We learn from the Administration Report on the railways in India for the calendar year 1900, that during this period 1237 miles of railway were completed and opened for traffic, bringing the total mileage open at the close of the year up to 24,707 miles. The principal railways opened were the Bengal-Nágpur railway, on the 5 feet 6 inches gauge, through to Howrah, giving direct communication by the east coast route between Howrah and Madras and southern India, and between Howrah and Bombay; the Moradabad-Ghaziabad railway, on the 5 feet 6 inches gauge, giving the Oudh and Rohilkhand railway direct access to the important trade centre of Delhi; the Hyderabad-Gódávari valley railway, on the 3 feet 3⅝ inches gauge, giving a more direct line between the Nizam's dominions and Central and Northern India; the metre-gauge line, connecting Sind with Rajputana, and giving direct communication between these provinces. Surveys were made for several new lines of railway. A large increase is noticeable in the number of passengers carried during 1900, which is pointed out as being partly due to the migrations caused by plague and famine, and partly to a natural development of the traffic and the opening of new lines of railway. There was also an increased goods traffic in 1900 over 1899. The principal increase was under general in merchandise, which largely consisted of food-stuffs moved long distances in consequence of famine; on the other hand, the movement of cotton fell, since the area affected by famine contained the best cotton districts in India. Indian coal is said to be fast displacing foreign coal on Indian railways. For the first time in the history of Indian railways, there was in the year 1900 a surplus to the State of revenue over expenditure amounting to nearly 8¾ lakhs of rupees. The report contains a map of the railway system of India corrected up to April 30, 1901, and a diagram.

Ascent of Gunong Tahan.—At least three attempts to scale Gunong Tahan, the third by Mr. Skeat of the Cambridge Expedition, who became so ill that he was obliged to turn back, have met with failure, but Mr. John Waterstradt has at last succeeded in making the ascent. The *Straits Times* for November 29 last contains an interesting account of the journey. Starting early in last May, a journey of a month up the Lebeh branch of the Kelantan river brought Mr.

Waterstradt to a mountain which he had supposed to be Gunong Tahan, but which the natives told him was Gunong Siam. This was about 5000 feet high, and from its summit Mr. Waterstradt saw what was reported to be the real Gunong Tahan. In order to reach this latter peak he had to return to the coast and ascend the Sungei Galas branch of the river, only to find that he had reached another Gunong Siam, some 6000 feet high. From the top of this, however, the real Gunong Tahan was at last seen, and Mr. Waterstradt was able to march at once towards it. He first tried whether an ascent from the Panang side was not after all possible, but after climbing some 4000 feet, he was confronted by an impassable wall of rock, down which a magnificent waterfall fell at least 200 feet into the Tahan river. On the north or Kelantan side, however, the ascent was found to present comparatively few difficulties, though, owing to the almost impenetrable character of the jungle, it took four days to climb the 7500 or 8000 feet which, much to his disappointment, Mr. Waterstradt found to be the greatest altitude of the mountain. Mr. Waterstradt stayed at the top of Gunong Tahan for a fortnight, and as a result of his observations describes the mountain as consisting of three separate ridges running from east to west, with deep gullies between. The middle ridge is the highest. Very small shrubs and trees, covered with moss, are found at the top. Rain fell almost incessantly during the fortnight, and the Malays suffered greatly from the cold, the temperature averaging 60°. The native tradition is that the top of Gunong Tahan is a mass of gold, and Mr. Waterstradt is of the opinion that the mountain is well worth prospecting. Numbers of elephants were seen at the base, but on the mountain itself only a very few small birds. The return journey entailed terrible suffering on all the party, but Mr. Waterstradt succeeded in getting to Singapore fine collections of birds, insects, and land-shells, including several new specimens.

Hydrographical Expedition to Indo-China.—It has lately been announced by the *Politique Coloniale* that an expedition, under the command of Lieut. Héron, and including several other officers on its staff, was to leave Marseilles for Indo-China on January 12. Its object is to complete our knowledge of the coasts of Indo-China by accurate surveys, and to study the distribution of terrestrial magnetism in that region, besides carrying out general investigations in matters relating to hydrography and navigation. It sails under the orders of the Minister of Marine.

Ascent of the Yang-tse Rapids by a French Gunboat.—We learn from the *Tour du Monde* (No 2, 1902) that the rapids of the Yang-tse were successfully ascended last October by the French gunboat *Olry*, in command of Lieut. Hourst, who is thus putting to good use, in another quarter of the globe, the experience of river-navigation gained by him during his perilous descent of the Niger. It is incorrectly stated in the paper referrred to that no vessel had previously made the ascent. Lieut. Hourst's mission will, it is expected, take him into the western provinces of China, possibly including Yunnan.

Structure and Divisions of the Coast of Eastern Asia.—Baron von Richthofen has published the second of his studies on the Geomorphology of Eastern Asia in the *Sitzungsberichte* of the Prussian Academy (1901, No. xxxvi. pp. 782–808). The first, noticed in the *Geographical Journal*, showed how, from Cape Dezhnoreff to Yunnan, the margin of the Asiatic plateau was due to an alternation of north-south and east-west fractures, the former discordant, the latter concordant, with the feature lines of the plateau. When the fact that the coast-line does not necessarily trace out a structural boundary is allowed for, a similar alternation of fractures can be traced from Gishiga bay, 62° N., at the north-east angle of the Sea of Okhotsk, to Cape St. Jacques, east of the Mekong delta. The following divisions may be distinguished: (1) The Stanovoi coast from Gishiga

bay to the mouth of the Ud, attached by the short stretch of transverse Tugur coast to (2) the Tungus coast from Cape Alexander, north of the mouth of the Amur, to the former island, now peninsula, of Khodo, or Hodo, shown on the new Stieler map as close to Hamheung, but given by Richthofen as 50 kilometres to the south-west of that place. A great rift occurs in this coast between Capes Povorotnyi and Mong-pai-kot (Boltin, or Bruat). (3) The Korea coast, from Port Lazareff (Wönsan) to the cape east of Fusan, and probably by Quelpart island to the Saddle group in the Hangchou bay. The southern sunken region is the boundary of the Yellow sea. (4) The China coast, from the Saddle islands to the north of the Red River delta, broken by the Laichou peninsula. (5) The Annam coast from Vinh to Cape St. Jacques. These are explained by two series of sinking on the Pacific side, the earlier, perhaps not younger than the archæan foldings in the case of the Tungus coast, caused the east and west fractures; and that at a later period, probably not earlier than the Trias, caused the meridional faultings.

The Sikhota-alin are described in the above paper from accounts by Ivanoff and Batsévich (*Comité Géol. de Russie*, 1900, pp. 109–198). They consist of a succession of steep bare ridges rising above pine-covered valleys, all running south-south-west to north-north-east. The longitudinal furrows are here and there joined by transverse gaps which have valley divides, and the main water-parting does not follow one definite ridge. The rivers running to the Usuri and Amur are from three to six times as long as those flowing directly to the sea. The highest part is composed of archæan rocks, which are folded, but the longitudinal furrows are due to fractures. Coal is found in the Jurassic rocks. The Miocene strata, containing lignite, lie horizontally; all others are disturbed. The coast is concordant, steep and lofty as far south as Vladimir bay, beyond which it cuts the grain of the land obliquely, and small rias are found, but do not form good harbours.

Return of the Jesup Expedition.—The members of this expedition, which, as our readers are aware, was organized by the New York Natural History Museum with the means placed at its disposal by Mr. Jesup, returned through Europe from North-Eastern Siberia in November last. A short account of the work accomplished, taken from the Russian *Viedomosti*, is given in a recent number of *Globus* (vol. lxxx. No. 21). During fourteen months the expedition traversed Northern Kamchatka, the Anadyr region, and other parts of North-East Asia, making extensive ethnological observations on the Chukches, Eskimo, Koriaks, Kamchadales and Lamuts, and securing valuable collections, both ethnological and zoological. The linguistic material collected is sufficient to permit the preparation of a comparative grammar of the Chukche, Koriak, and Eskimo languages. According to the observations of Mr. Bogoras, one of the Russian members of the expedition, the Chukches, Koriaks, and Kamchadales are connected by their folk-lore and language with the North American Indians, but not with the Eskimo. Kamchatka is now almost entirely Russianized, the native language being spoken in six or seven villages only. The second Russian representative, Jochelson, did not return with the rest, having stopped to visit the Yakuts on the way home.

Hertz's Mammoth Expedition.—A welcome piece of news is a telegram received from Yakutsk, about the expedition which was sent out last summer by the St. Petersburg Academy of Science for the examination of a mammoth corpse discovered in the district of Kolymsk. The telegram, dated "Yakutsk, December 15 (28), 1901," runs as follows: "The expedition which was sent out by the Academy of Science for the exploration of the mammoth discovered in the district of Kolymsk, under zoologist Hertz, has reached Sredne Kolymsk, after having experienced very great difficulties, bringing with it the mammoth. It was found, on examination of the corpse, that the animal was a male, middle-aged,

Its skeleton and skin, with few exceptions, were found complete. Tail short, and covered with long hair. In the stomach, between the teeth, and on the tongue, the remains of undigested food were found. The recovered parts of the mammoth are being conveyed to St. Petersburg in a frozen state."

The Trans-Siberian Railway.—The laying of the last rail of the great Trans-Siberian railway took place early in November last, and it is hoped that through communication with the Pacific coast will shortly be established, though much still remains to be done in the way of ballasting, etc., before the line can be in thorough working order.

AFRICA.

Count Wickenburg's Journey from Jibuti to Lamu.—Count Wickenburg, whose journeys in Somaliland a few years back were referred to at the time in the *Journal*, sends us an account of an expedition recently carried out by him from Abyssinia to the Rendile country and on to the coast at Lamu by way of the Lorian swamp, across one of the largest remaining blanks in our map of East Africa. From Balchi, some 40 miles east of Addis Abbaba, which was left on April 21, 1901, the traveller went south by the chain of lakes explored by Wellby, Erlanger, Neumann, and others, to Stefanie, passing through the Konso country inhabited by an industrious population which has built regular walled towns. Like other recent travellers, Count Wickenburg found abundant signs of the drying up of Lake Stefanie, only the northern part containing water. Hence, after a visit had been paid to Lake Rudolf, a start was made on July 27, for the exploration of the country lying between Rudolf and the Lorian swamp—the main object of the expedition. After crossing the mountains south of Stefanie, the count traversed uninhabited plains which became more and more arid until they took the form of a desert covered with huge black rocks. On August 8 water was at last found in a mountain range named Huri, about 50 miles long and terminating towards the south-east in a huge rocky mountain, some 6500 feet high, called Foroli both by the Boran and Gabra. After following for a time a line of isolated peaks rising to an average height of nearly 5000 feet, the traveller again found himself in a waterless desert, which seems to extend east to the Jub and south to Lorian. He was thus forced to make direct for the Marsabit range, whence he visited the Rendile tribes, camped some 25 miles to the north close to Korole. This is not a hill, but a dry lake with brackish springs in its bed. The Marsabit range, in which are three craters, is partly covered with dense forest, and its good water and delightful climate render it a true oasis in the desert. From this range Count Wickenburg, like Dr. Donaldson Smith, went south to Lasamis, and thence through dense bush to the Guaso Nyiro. Rendile were again met here, as well as many kraals of Laigop. The former inhabit the country between 3° N. and the Guaso Nyiro, extending west to Mount Kulal. The country further north is now uninhabited, the Abyssinians having forced the Gabra to live near the Boran. Lorian was found to be nearly dry, and seems to have no outflow. From it the traveller struck south for the Tana, finding water at long intervals in dry river-beds. The Tana was reached at Korokoro, and descended in canoes to Kepini, whence the count proceeded to Lamu. He has executed a plane-table survey of his itinerary, and hopes to publish a map. From Lamu he proposed to start again for Lado or Fashoda, and to explore the country between Lake Rudolf and the Nile.

Ukamba.—Mr. Ainsworth's report on this province of British East Africa states that it is as yet too early to judge how far and in what manner the Uganda railway has influenced the natives. Nairobi is now the ultimate starting-point for most traders to the further interior. Nearly all the retail native trade is in the

hands of Indians and of a few Greeks, while the wholesale trade is mostly carried on by Indians and one or two German houses. Scarcely any British firms compete. At many places the Indian bazaars have taught the local natives the value and use of money. There is a large amount of land in healthy localities which could be occupied by Europeans, and here the cereals and fruits of temperate lands succeed. Thus wheat and barley, and various European fruit-trees and vegetables, especially potatoes and onions, do well. There should be eventually a large market for East African potatoes, for they are superior to any imported kinds. The pastoral prospects of the country are also good. Cattle and sheep thrive, and there is some of the best grazing in Africa on the Kapte and Athi plains. On these, and in the highlands, horses will live, and the tsetse-fly is confined to the lower country south of Ulu. The average rainfall of the last ten years is stated to be over 50 inches, though in 1898 and 1899 there was a drought. The mean average temperature at 9 a.m. is about 64°, and at midday about 75°.

Captain Herrmann on the Kivu Volcanoes.—A communication has been received in Germany from Captain Herrmann, leader of the German section of the Kivu delimitation commission, giving an account of his observations in the neighbourhood of the Kivu volcanoes. It is printed in the last number of the *Verhandlungen* of the Berlin Geographical Society, and confirms in the main the statements of previous travellers. The great outbreak of Namlagira, one of the western group of peaks, by which a large area of forest was destroyed, has now ceased, but lava still continues to flow slowly. The two central peaks, both rising to a sharp point, and of which one, viz. Sabingo (the Sabiin of Moore), is likened to the Winklerturm in the Dolomites, are estimated at over 13,000 feet. This and the western group, as seen from the mission station of the White Fathers, present a view which for weird impressiveness can scarcely be matched in the world. Like other travellers, Captain Herrmann discovered many hot springs and lakes, some of the former being sulphurous and others of very various flavours.

Place-names at the Cape in the Eighteenth Century.—M. H. Déhérain discusses in *La Géographie* (September, 1901), the system of place-names which prevailed during the Dutch period at the Cape in the eighteenth century. Of the three native races with which the early settlers came in contact—the Hottentots, Kaffirs, and Bushmen—only the first exercised any influence upon the nomenclature of the period, and this but a slight one. "Houtniquas," which in the eighteenth century signified the long depression between the sea and the mountains from Mossel bay to the Kromme rivier, but is now applied only to a chain of mountains, was the name of a Hottentot tribe, and "Karroo" had its origin in the Hottentot word *Karusa*, a "dry and barren spot." The names "Krakekamma" and "Sitsikamma," applied in the eighteenth century, the first to the country between the Gamtoos and the Sundag rivier, the second to that east of Algoa bay, may also be of Hottentot origin. The bulk of the place-names were, however, Dutch, and these were as a rule based on some attribute of the features described (Zwartberg, Breede rivier, Cedar Berg, etc.), or on proper names. The names of six governors are, *e.g.*, commemorated in the names Riebeeks Kasteel, Stellenbosch, Swellendam, Graaf Reinet, Plettenberg's Baay. The nomenclature thus shows a singular lack of imagination, and it is surprising, also, how little the past associations of the colonists are recalled by the names. Elsewhere the Dutch, as well as other nations, perpetuated the memory of their homeland by such names as New Amsterdam, Hollandia, Zeelandia; but of the South African place-names three only appear to recall the origin of the colonists, viz. Hottentots Holland (east of False bay), Fransche Hoek (a village settled by Huguenots in 1688), and the Orange

river. M. Déhérain explains this by the inferior condition of most of the settlers and the cessation of intercourse with the mother-country.

Mud Island in Walfish Bay.—On June 1, 1900, the appearance of a mud island just within the point which closes Walfish bay on the south was noticed from the settlement at the head of the bay by Miss Cleverley, daughter of the resident magistrate, who immediately went with a party to examine the phenomenon. A description of the island, with photographic illustrations, is given by Mr. F. W. Waldron, of the Public Works Department at Cape Town, in the *Transactions of the South African Philosophical Society* (vol. xi. part 3). Mr. Waldron points out that the soundings within the bay are in general from 3 to 8 fathoms, though within the peninsula on the south side, which terminates in Pelican point, the water is shoal, and the coast at the bottom of the bay is low and marshy. The bottom on all the coast is formed of a dark muddy sand, which turns metals black, making them appear as if painted. The examination showed that the island was approximately 150 feet long by 30 wide, and rose to the considerable height of 15 feet above the water. The sides fell nearly vertically under water to depths of 7 and 8 fathoms, but above water pieces had been washed off by the sea, giving the contours a jagged appearance well shown by the photographs. A strong odour of sulphuretted hydrogen pervaded the spot, and steam appeared to issue from the northern end of the mass. On June 2 Lieut. Gutsche swam off from a boat and procured a specimen of the mud, the water proving cold, and the island too giving no indication of heat. The water was dirty, and its surface covered with bubbles, while a few dead fish were found on Pelican point. By June 7 the island had entirely disappeared. As a probable cause of the presence of gases in the mud, Mr. Waldron points to the large quantities of animal matter which must be collected in the bay from the myriads of sea-fowl, as well as from fish and whales, remains of the latter being strewn along the coast for miles. Submarine disturbance near the locality is suggested by the breakage in the telegraph cable to German territory, which happened a few weeks previous to the upheaval of the island.

Colonel Péroz in the French Sahara.—Colonel Péroz, administrator of the third "military territory" of French West Africa—that lying between the Niger and Lake Chad—succeeded early last year in making the journey to Zinder entirely within French territory, round the northern circumference of the British Sokoto territory. A short account of the journey, communicated by Colonel Péroz to the Paris Geographical Society, was published in *La Géographie* for September last. Many difficulties were encountered, both on account of the scarcity of water, the insufficiency of the transport, and the open hostility of the Tuareg. From Sorbo Hausa to Zinder, a distance of 600 miles, only a single piece of water—the Tamaski marsh—was met with until quite close to Zinder. The route led over uniform undulations of sandy soil, the relief becoming more accentuated in one section only. As a rule the valleys and beds of ancient rivers are blocked with the *débris* of the sandstone which once formed the framework of the country. The level rises regularly to 2000 feet, afterwards falling to 1250, and again rising to 1650. On the plateaux the vegetation consists of thorny scrub, stunted trees, and short thin grass, but it is richer in the depressions, where palm-trees are numerous. Almost all the commercial movement is from north to south and *vice versâ*, the only transverse route of importance being that from Kano and Sokoto to Ilo. In March, April, and May the temperature is very high, 40° to 42° C. (104° to 107°·6 F.) being regularly registered at 2 p.m. by thermometers in the shade and with a north exposure.

Exploration in the Southern Kamerun.—An important expedition, which

has resulted in valuable addition to our knowledge of the southern interior of the Kamerun, has lately been carried out by Baron von Stein, whose former good work, while in charge of the station of Lolodorf, on the upper Lokunje, has already been noticed in the *Journal* (vol. xiv. p. 664, xvi. p. 562). On his new expedition, the Baron, who is now in charge of the newly opened German districts on the Ngoko, and started this time from the extreme east of the Kamerun, was able to push far enough westward to link his route with his former surveys from that direction. Starting on April 16, 1901, from the newly founded port of Yukaduma (Pleyn's Bumbum), the expedition passed for nine days through entirely uninhabited primeval forest—the "dead zone" of the German traveller, though this refers only to the absence of human inhabitants, the numbers of game, especially elephants and buffaloes, being described as enormous. For the greater part of the distance the country was quite level and exceedingly well watered by the Bumba (upper Ngoko) and its tributaries, the main stream being crossed at the western end of the "dead zone." The geological formation remained the same to the western terminus of the whole route—laterite underlaid by either gneiss or granite. Occasional grassy stretches suggested, by their flora and fauna, that the grass-lands of the north were at no great distance. On the 25th the district of the Njem, or Njima, was entered, Bule traders from the north-west being also encountered, and after again traversing an uninhabited tract a halt was made at the village of the Njem chief Bijum. The expedition was now within a great bend made by the important river Ja, which flowed at no great distance both on the north and south. Proceeding westward, however, the expedition marched for a number of days without reaching the end of the bend, which seemed to widen out westwards from three to six or more days' journey across. A continuous westerly route through districts of the Bule tribe led, however, at last to the river, which, where crossed, had a width of 70 yards and a depth of 20 to 25 feet. The extreme western end of the bend seems to be in about 12° E. Crossing an important tributary, the Lobo, Baron von Stein reached the western limits of the Bule districts, and was able to refit at the village of Ngulemakong, proviously visited by him from the west, which was reached on June 5. The Ja, on which this journey has thrown so much new light, has but a slight fall, and, except at one spot, seems to be navigable throughout the region traversed. It has important tributaries from the east, one of which is the Libe,* and seems to have its origin in a source-region which gives rise also to the Bumba, and tributaries of the Nyong and Kadei. Baron von Stein still holds to the belief that it belongs to the Ngoko system, but, as is pointed out by M. Wauters, it would seem to belong to the Ogowe basin, at least if identical with the Ja of Lesieur (*Journal*, vol. xviii. p. 535). The great forest has been shown by this expedition to extend further north than had been imagined, reaching the Nyong, if not the Sanaga, in places. The Bule tribe stretches further east than has been supposed, while in the east of the region nomad dwarfs are very numerous and are the chief purveyors of ivory, which, apart from rubber, is the only product of the country yet capable of exploitation. Further reports from Baron von Stein, to which we hope to recur shortly, have since been published in the *Deutsches Kolonialblatt*, from which the above information is also taken.

AMERICA.

The Coal Measures of Canada.—The coal area of Canada is estimated by Mr. Johnson, the Dominion statistician, at 97,200 square miles; but this estimate

* It seems possible that this name may have given rise to the rumours of a Lake Liba, formerly current in the neighbouring regions.

does not include areas in the far north which are known to exist, but remain undeveloped. As regards their position, the coal measures of the Dominion are described as being exceptionally situated. The extreme eastern and western fields are on the coast-line. The provinces of Quebec and Ontario, which are without coal, are compensated by the possession of innumerable waterfalls, with a combined energy of many millions of horse-power, affording every advantage for the production of electricity at a cheap rate.

Ice Caves and Frozen Wells in the United States.—Mr. H. H. Kimball, of the Weather Bureau of the United States, has lately made a study of some of the more remarkable instances known in America of permanent accumulations of ice in caves or wells, and gives the results of his researches in the *Monthly Weather Review* for August last. Mr. Kimball began by carefully studying the literature of the subject, the result being to show to what a large volume it has already attained. According to a statement by Mr. Balch in his work on 'Glacières, or Freezing Caverns,' published in 1900, the formation of subterranean ice has been recorded from nearly 300 places in the entire world, some 65 of these being in the United States. Mr. Kimball describes some of the latter from the accounts of various writers, and then proceeds to give the results of his own observations. The localities examined included the mines at Port Henry, N.Y., and various caves, etc., in Vermont. Of the Port Henry mines most present no unusual phenomena, being described as warm throughout the year; but one mine, No. 21 of the Port Henry Iron Ore Company, is remarkable as containing ice throughout the year, while the winter temperature is excessively low, −38° F. having been recorded. The reason given by Mr. Kimball is that the entrance to the mine is a pit, wide at the top and gradually tapering downwards, the roof having been blown off with dynamite. This favours the gravitation of the cold dense air towards the bottom, 500 feet below the surface. Here an air temperature of 36·2° Fahr. was registered by Mr. Kimball in August. In the Pittsford ice-cave near Brandon, Vermont, the ice is found in a pit reached by a hole in the side of a mountain gorge. Here again there is no tendency for the warm surface air to flow in and replace the cold dense air of the cave. The lowest air-temperature observed was 35·2° Fahr. Near Wallingford, Vermont, an immense talus of quartz rcck abuts on the mountain, among the boulders of which an air-temperature of 45° was observed, though the surface air-temperature halfway up the talus was 70°. A spring issuing from the base at the low temperature of 41·0° indicated the presence of ice at inaccessible depths in the talus. As regards the frozen well at Brandon, Vermont, where a frozen stratum was encountered on the first digging of the well, some have supposed this to be a survival from the Glacial epoch; but as the geological formation—a moraine composed of small pebbles—favours the circulation of air through the strata, Mr. Kimball is inclined to attribute the presence of ice to the same causes and the same general principles that apply to the other cases. The ice caves and frozen wells are, he thinks, but different manifestations of the same phenomenon. In winter the cold air circulates to unusual depths, freezing the water with which it comes in contact; while in summer heat finds its way to the ice only by the slow process of conduction.

The Brazil-Bolivian Boundary.—The announcement is made in the second number of *Globus* for the present year that the commissions which have been at work on the delimitation of the boundary between Brazil and Bolivia have, with great labour and danger, explored the little-known course of the Yavari, the source of which was found to lie in 7° 6′ 55·3″ S., 73° 47′ 30″ W. The work was attended with considerable loss of life, the victims including two of the Brazilian commissioners.

AUSTRALASIA AND OCEANIC ISLANDS.

Report of the Department of Lands and Survey, New Zealand, for 1900–1901.—The report by Mr. A. Barron, Assistant Surveyor-General of New Zealand, on the operations of the Department of Lands and Survey for the twelve months ended March 31, 1901, contains a large amount of geographical matter relating to the colony. It gives a full account of the survey work during the year, land transactions, road construction, and other works. With regard to the trigonometrical and topographical surveys, the largest area done during the year was in the district of Auckland, where 518,570 acres were triangulated and mapped, chiefly in the Urewera country; other areas dealt with were: in the south-west of Southland, 148,000 acres; in Hawke's Bay, 56,100 acres, in the Moeangiangi and Tongoio districts; while Mr. H. M. Skeet finished the topographical survey of Mount Egmont, 72,400 acres. In Otago Mr. W. T. Niell's survey of the country around Dunedin for the Intelligence Office embraced 85,000 acres. Progress has been made in the magnetic survey of the colony. Mr. Coleridge Tarr made observations at eighty stations, viz. seventeen in the northern part of the Middle Island, and sixty-three in the North Island, chiefly on the coast-line from Wellington by the west and north to the Bay of Plenty on the east. A base station was to be established at Christchurch, which will probably be used by the British Antarctic Expedition as its base station. The appendices deal with such matters as land settlement, administration, surveys, roads, river works, magnetic survey, sanctuaries for wild animals, forestry, village settlements, etc. The report contains a number of maps, plans, and illustrations.

Annexation of Rimatara by France.—The small island of Rimatara, the westernmost of the Tubuai or Austral group in the South Pacific, was, with its dependencies, the Maria islands, formerly annexed by France on September 2, 1901, on the request of the principal inhabitants.

POLAR REGIONS.

Baron E. W. Toll's Arctic Expedition.—News, and good news too, has at last been received from the Arctic Expedition of Baron Toll. It was in the form of the following telegram addressed to General Rykatcheff, head of the Central Meteorological Observatory, which telegram must have been conveyed to Yakutsk by a messenger of the expedition, and thence wired to St. Petersburg. It was dated "Yakutsk, December 4 (17), 1901," and ran as follows: "On September 11 (24), winter overtook us in Nerpichiya bay, 75° 22′ (N.) and 137° 16′ (E. long.). From November 1 (N.S.) we have opened a (meteorological) station with hourly observations. All right; all well, sending greetings (to) Chief Observatory. *Zarya*, October 25 (November 7), 1901." The bay where the expedition is wintering is thus not far from Ust Yansk, to the north-east of it.

Dr. Ekstam's Expedition to Novaya Zemlya.—In addition to the Russian Expedition under Borissov, already alluded to in the *Journal*, a Swedish party, under Dr. Ekstam, was also at work during 1901 in Novaya Zemlya, though the results were smaller than had been hoped on account of unfavourable climatic conditions. A short account of the expedition was recently given in *Globus* (vol. lxxx. No. 19). The start from Archangel was much delayed by the masses of drift-ice, and when at last Matochkin Shar was reached, this was found to be so blocked that it was impossible to pass through the strait to the proposed scene of operations on the east side of the islands. Dr. Ekstam decided therefore to proceed northwards along the west coast in order to complete his investigations made there in 1891 and 1895. He paid special attention to the condition and mode of life of

the Samoyede immigrants from Northern Siberia, who maintain a difficult existence in groups of two or three households, living on the proceeds of the chase of wild reindeer, polar bears, etc., and by fishing. In unfavourable summers, however, they are unable to lay in a sufficient supply of food for the winter, and are then forced to kill a portion of their dogs, and so are placed at a further disadvantage for the hunt of the next season. Dr. Ekstam considers the climate far worse than that of Spitzbergen, in spite of its more southerly position. This he explains by the less favourable influence of marine currents, and the greater proximity to the pole of cold. In 1901 the mean temperature varied between 5° and 10° C. (41° and 50° Fahr.), but in some seasons higher temperatures are reached, and the west coast then assumes a green appearance. Dr. Ekstam hopes to undertake a new expedition during the present year.

The Antarctic Expeditions.—The *Discovery*, with the British Antarctic Expedition on board, sailed from Lyttelton, N.Z., on December 21, and made her final start for the Antarctic from Port Chalmers on December 24. Before this a message had been sent by the king, bidding God-speed to the expedition, and wishing it every success. The following telegram was despatched by the commander from Port Chalmers, on December 24: "Please convey to His Majesty our respectful thanks for gracious message of farewell. Please wire to all relations Good-bye; all fit, well, and cheerful. Merry Christmas and Happy New Year. Confident of happy return. Thoughts will be with you.—*Discovery*." Despatches from Captain Scott, giving an account of the scientific work carried out during the voyage, have been received by mail, and will form the subject of the address by the President at the Society's meeting on February 24. The vessel which conveyed the additional supplies for the *Gauss* from Sydney to Kerguelen Land has now returned, and reports all well with the German Expedition, which has duly reached its final base.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Apparatus for recording Water-levels.—Amongst the most important of the devices now in use for affording protection in case of floods are instruments for recording and reporting the water-level at distant points. The essential part of most of these consists of a style which, by means of an electrical attachment, draws a curve showing the variations of level. The drawbacks incidental to apparatus of this type are that any slight instrumental error which causes an ordinate or abscissa to be drawn out of scale, is magnified as the record continues, and that a temporary stoppage of the pen may pass altogether unnoticed. Thus the record may become untrustworthy to such an extent as to be worse than no record at all. A new instrument on the Siedek-Schäffler system, which has just undergone a series of tests by the Central Hydrographic Bureau in Vienna, is free from the defects named. At stated intervals (of less than an hour) the movements of the float cause the actual water-level to be automatically printed in figures on a strip of paper, by electrical contact. By this system the changes of level at a whole series of distant points may be recorded at a central station, the operation of recording a complete observation occupying only three-quarters of a minute. The apparatus is at present in operation on the Moldau in Bohemia, and it is proposed to erect a number of sets on the Danube. Full information regarding its construction will be found in the *Oesterreichische Monatschrift für den öffentlichen Baudienst*, No. xii., 1899.

Climatic Contrasts.—In No. 3 of the third volume of the *Abhandlungen* of the Vienna Geographical Society, Dr. Ludwig Coellen gives a clear statement of the great contrast between the climatic conditions on the east and west sides of the northern continents north of the tropics, which is so marked a feature of

meteorological maps. He properly devotes his first part to the winds, next compares the ocean currents, next the temperatures, next the moisture, and lastly the vegetation, of the two sides of the continents. The wind and temperature are most fully discussed, and some useful tables of data are given. He retains the unfortunate and inexact terms "insular" and "continental" climates.

GENERAL.

Oases and Islands.—The many points of resemblance between oases and islands, from the point of view of human geography, are well brought out in a paper by Willy Marcus, printed, with a number of other instructive studies, in the *Festschrift*, brought out by the Geographical Seminary of Breslau University in honour of the meeting last year in that city of the German "Geographentag." The comparison is, of course, no new one, having been a favourite point on the part of students of anthropogeography from Ritter to Ratzel, to say nothing of earlier writers; but Herr Marcus goes more fully into the subject than most of his predecessors, and supports his thesis by abundant illustrations drawn from the actual observations of travellers and others. He approaches the subject from the point of view (1) of the influence of the isolated position of islands and oases; (2) of the relation of such features to the uninhabited expanse around them; and (3) of the effect on the life within them of their limited area. In the case of both islands and oases, the isolation from the rest of the world has introduced an element of mystery into men's conceptions of them, and has also made them favourite retreats of hermits, monks, and the like, as well as places of banishment and retreats in times of danger and disturbance. The influence, especially climatic, of the surrounding medium, though different in the case of oases and islands, leads to surprisingly analogous results. Vegetation is limited in each case, and in the date-palms of the one and the coco-nut palms of the other, the inhabitants find their chief support and reliance for common necessaries. In both cases the surrounding medium is a source of danger, arising both from the forces of nature (waves of the sea and of sand) and from the sea and land-robbers which infest them. The restricted area leads commonly to the massing together of a dense population, and the attendant risks of over-crowding, as well as to frequent degeneration, whether from the want of new blood as a renovating agent, or from the cramping influence on the conditions of life. Both islands and oases are often an easy prey to external enemies, and the internal life of the inhabitants shows striking analogies in the want of adhesion, and even positive enmity between the separate communities into which they are broken up. They thus occupy a relatively unimportant place in the general history of the world, their chief *rôle* being that of links in the chain of communications across vast seas and deserts. In spite of these analogies, some important differences are to be noticed, the desert alone being truly characterized as a barren waste and a barrier to intercourse, and forming a strong contrast to the ocean with its teeming life and, in modern times at least, its *rôle* as a link between the nations.

OBITUARY.

Sir Francis De Winton.

THE death of Major-General Sir Francis De Winton, R.A., G.C.M.G., C.B., which, we regret to announce, occurred on December 16, deprives the Society of the services of one who was at once a valued member of its Council and an authority on matters relating to Central Africa. Born in 1835, Sir Francis entered

the army during the dark and stormy days of the Crimean War, through the latter half of which he served with considerable distinction. Subsequently he occupied positions of importance under Sir W. F. Williams in British North America and in Gibraltar, and, after serving for a short time as Military Attaché at Constantinople, returned to Canada in 1878 with the new Governor-General, the Marquis of Lorne. It was shortly after his return from Canada in 1883 that Sir Francis formed the first of those connections with Africa for which he is best known in geographical circles. It was he who was appointed by King Leopold, early in 1884, to take the place of Sir Henry Stanley in the territories which had been acquired by the great explorer on behalf of the International Association of the Congo, and his was the important work of preparing the ground for the introduction of some form of government into these territories, which were so shortly (1884–5) to be recognized by the European Powers as constituting an independent state. Sir Francis only remained in what is now the Congo Free State for two years, but during that time he travelled widely and studied the country carefully, and it was he who despatched the first steamer that ascended the Kassai. On his return in 1886, he was elected a member of the Society's Council, and at one of the evening meetings he read an interesting paper on the Free State (*Proceedings*, New Series, vol. viii.). For some years he was one of the honorary secretaries of the Society, and in 1889 he presided over the geographical section of the British Association Meeting at Newcastle-on-Tyne. Previous to this, however, he had in 1887–88 commanded a punitive expedition against the Yonnis of Sierra Leone, and had been chosen to act as secretary to the Emin Pasha Relief Expedition. At the end of 1889 he was sent out to South Africa by the Government, and in conjunction with commissioners appointed by the Government of the Transvaal, held an inquiry into the position occupied by Swaziland. On his return from this mission, he was appointed Governor of British East Africa, then administered by the Imperial British East Africa Company, and his residence in this part of the Dark Continent enabled him to complete the practical knowledge of affairs relating to Central Africa, which he had begun to acquire in the Congo Free State. This was the last post that he held abroad, however, for soon after his return in 1891, he was appointed controller of the household of first the Duke of Clarence and then the Duke of York, from which latter post he retired only a short time ago. Sir Francis was compelled to vacate his seat on the Council in 1890, but he resumed it in 1899, and filled it until his death.

The Rev. Thomas Wakefield.

The death of the veteran missionary Erhardt has been quickly followed by that of another East African pioneer, the Rev. Thomas Wakefield, who, like the former, took advantage of his long residence as a missionary on the East Coast to engage in researches on the then mysterious geography of the remote interior. Mr. Wakefield possessed the true instinct of a geographer, and, while contributing not a little by his own journeys to an improved knowledge of the East African coast-lands, will be perhaps chiefly remembered by geographers for his almost unique contributions to geography by the method of careful inquiry among the members of native trading caravans, which enabled him to forestall to some extent the results of actual exploration. Towards this end he was no doubt assisted by his good fortune in meeting with such competent interpreters of his material as Mr. Keith Johnston, and, subsequently, Mr. Ravenstein, but such aid could have done little to unravel the intricacies of the geography of the interior apart from

the remarkable perseverance and accuracy in recording displayed by the inquirer on the spot.

Mr. Wakefield was born at Derby in 1836, and at the age of sixteen years was apprenticed to the printing trade at Nantwich. Afterwards he entered the ministry of the Wesleyan Association, now the United Methodist Free Churches, and worked for several years in Cornwall. He began his work as a missionary in East Africa some forty years ago, being one of a band sent out by the United Methodist Free Churches in 1861, under the leadership of Dr. Krapf, his sphere of labour lying in the Ribe district near Mombasa, which remained his headquarters in spite of the many journeys which he undertook in the Galla and Somali districts to the north. The first of these was made in 1865, and the second, on which he was accompanied by his fellow-labourer Mr. New, and which extended beyond the Tana to Patta, in 1866–67. An account of the first of these journeys was published in 1866, under the title 'Footprints in Eastern Africa.' In 1870 he presented to our Society the first instalment of native information, based on the routes of caravans, which was published in the Society's journal, accompanied by a map by Mr. Keith Johnson, in which the whole of the existing information from various sources was embodied, and which, when compared with modern maps, shows a surprising degree of accuracy when the hearsay nature of the intelligence is considered. Among the names of remote places derived from Mr. Wakefield's itineraries we find those of such now familiar localities as Elgeyo, Lumbwa, Suk, Lorian, Kavirondo, Laikipia, some of which have been first reached by Europeans within quite recent years. In 1878 Mr. Wakefield returned to Europe after a second lengthened stay in East Africa, again bringing notes which proved of much value to cartographers. A journey made by him in the Southern Galla countries in 1877 was described in the *Proceedings* for 1882, and the same volume contained a further instalment of native itineraries collected by him, one of which included an account of the cave-dwellings of Mount Elgon, soon afterwards visited by Joseph Thomson, while another described a route to the country east of Lake Rudolf, into which Dr. Donaldson Smith was the first white man to make his way thirteen years later. Other itineraries leading into the very heart of the Galla and Somali countries were published by Mr. Ravenstein in 1884 from Mr. Wakefield's notes.

The zealous missionary's labours in East Africa, to which he had returned in 1883, were continued for some years longer, but his active work in the cause of geography was now at an end. He finally returned to this country in 1887, but continued his ministerial work for the Methodist body, of which he was elected president in 1888, in various English towns. His last sphere of labour was at Southport, where, after being for some time in failing health, he died on December 15 last. He was twice married, in 1869 and 1883, his first wife and infant son having died at Ribe in 1873.

Mr. Wakefield had been the recipient of the Murchison Grant of our Society in 1882, and became a Fellow in 1889. It had once been his intention to publish his copious notes on the Gallas, their history, folk-lore, etc., and it is matter for regret that want of leisure prevented the realization of this purpose.

Alexander Charles Allan.

News has been received of the death in July last, at St. Kilda, Melbourne, of Mr. Alexander Charles Allan, formerly Assistant Surveyor-General to the Government of Victoria, and a Fellow of the Society since 1891. Mr. Allan left Scotland for Australia in the early fifties of the last century, and, being a trained surveyor,

speedily obtained a post in the Victoria Survey Department. The excellence of his work quickly marked him out for promotion, and when the Geodetic Survey of the colony was undertaken in 1857, he was one of the first to be selected to carry out the work. In 1858–59 he measured the base-line on the Werribee plains and commenced the primary triangulation of the colony, and continued to do important work until the conclusion of the survey. In 1873 he was one of the two surveyors appointed to fix the boundary-line between Victoria and New South Wales from the easternmost source of the river Murray to the sea. The work of marking out the boundary fell to Mr. Allan, and in the space of eighteen months he carried the line from the starting-point to the coast with such accuracy, notwithstanding the fact that the country traversed was very mountainous and presented great difficulties, that it came out only 16 feet 8 inches from Conference point on Cape Howe, the beacon on either side of which it had been agreed to allow the surveyor a latitude of 110 yards. Subsequently, first as Chief Inspector of Surveys and then as Assistant Surveyor-General, Mr. Allan rendered further valuable service to the Government, but in 1878 he retired from public office and took up private work.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1901–1902.

Fourth Ordinary Meeting, January 13, 1902.—General Sir HENRY W. NORMAN, G.C.B., G.C.M.G., C.I.E., in the Chair.

ELECTIONS.—*Captain H. Bosquet; Frederic Burrow; James Frame; James Hillyer; Tom George Longstaff, M.A., F.R. Met. Soc.; Frank Wm. Lucas, M.A., B.Sc.; Howard Martin; James Scott; Alfred John Sifton; Arthur Wilcox.*

The Paper read was:—

"From Shanghai to Bhamo." By Dr. R. Logan Jack.

Wednesday, January 8, 1902, at 4.3 p.m.

Lecture on Waves to Young People. By Dr. Vaughan Cornish.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

THE following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

France. *B.S.G. Lille* **36** (1901): 184–203. **Malotet.**

De la Scarpe à l'Escaut: L'Ostrevant. Par A. Malotet. *With Illustrations.*

Sketch of the physical and industrial geography of the plain of Ostrevant between the valleys of the Scheldt and the Scarpe.

France—Brittany. **Baring-Gould.**

A Book of Brittany. By S. Baring-Gould. London: Methuen & Co., 1901. Size 8 × 5, pp. xii. and 300. *Illustrations. Price 6s. Presented by the Publishers.*

The object of this book is "to prepare the mind of the traveller to appreciate what the guide-books point out to him as worth seeing." It does this by bringing into prominence the human background against which the objects seen by him in Brittany stand out, and which gives to them interest while stimulating his observation. The Breton people and their history are most vividly brought before the reader, and the work should add much to the enjoyment of the annually increasing number of English visitors to the district.

France—Dunes. *B.S.G. Com. Bordeaux* **27** (1901): 273–278. **Duffart.**

Sur l'âge des dunes et des étangs de Gascogne. Par Ch. Duffart.

France—Geology. *C. Rd.* **133** (1901): 391–394. **Thevenin.**

Dépôts littoraux et mouvements du sol pendant les temps secondaires, dans le bas Quercy et le Rouergue occidental. Note de M. Armand Thevenin.

France—Loue. *C. Rd.* **133** (1901): 394–395. **Berthelot.**

Sur les origines de la source de la Loue. Extrait d'une lettre de M. André Berthelot.

The writer considers that the Loue, the second spring in France for the volume of its waters, represents a subterranean arm of the Doubs.

France—Marans. **Debureau and others.**

B.S.G. Rochefort **22** (1900): 193–218; **23** (1901): 3–24, 61–80.

La Ville et le Comté de Marans, d'après les recherches de MM. Debureau, Alfred Etenaud, P. Cappon, etc.

France—Somme. *A travers le Monde, Tour du Monde* **7** (1901): 273–276. ———

Les transformations du littoral de la Somme. *With Map and Illustrations.*

Germany. **Halbfass.**

Beiträge zur Kenntnis der Pommerschen Seen. Von Dr. Wilhelm Halbfass. Dr. A. Petermanns Mitteilungen. Ergänzungsheft Nr. 136. Gotha: Justus Perthes, 1901. Size 11 × 7½, pp. vi. and 132. *Maps and Profiles. Price 10m.*

This will be specially noticed.

Germany. *G.Z.* **7** (1901): 625-635. **Hausrath.**

Die Verbreitung der wichtigsten einheimischen Waldbäume in Deutschland. Von Prof. Dr. Hans Hausrath.

Germany—Breslau. **Krauske.**

Breslaus Stellung im Schnellverkehr. Von Marie Krauske. Festschrift des Geograph. Seminars der Universität Breslau zur Begrüssung des XIII. Deutschen Geographentages. Pp. 221-236. Breslau, 1901. Size 9½ × 6½. *Maps.*

The maps are "isochronic passage charts," showing lines of equal time-intervals in railway transit from Breslau and Berlin as centres.

Germany—Education. *G.Z.* **7** (1901): 636–642. **Fischer.**

Der Geographieunterricht an den preussischen höheren Schulen und die Junikonferenz. Von Dr. Heinrich Fischer.

Greece—Historical. **Grundy.**

The Great Persian War and its Preliminaries: a study of the Evidence, Literary and Topographical. By G. B. Grundy, M.A. London: John Murray, 1901. Size 9 × 6, pp. xvi. and 592. *Maps and Illustrations. Price 21s. net. Presented by the Publisher.*

This will be the subject of a review.

Holland—Hydrography. **Veeren.**
Tijds. K. Ned. Aard. Genoots. Amsterdam 18 (1901): 877–908.
De Groenlosche Slinge en haar stroomgebied boven het dorp Winterswijk. Een onderzoek naar het verband tusschen de bodengesteldheid en de eigenschappen eener kleine rivier op Nederlandsch grondgebied. Door F. E. L. Veeren. *Plate.*

A study of the influence exercised by the surface features on the phenomena of a river.

Hungary—Carpathians. *M.G. Ges. Wien* 44 (1901): 124–139. **Puchleitner.**
Die Eiszeit in den Südkarpaten. Von S. Puchleitner.

Based on the researches of E. de Martonne.

Iceland. *J. Manchester G.S.* 17 (1901): 46–63. **Newby.**
Iceland and the Icelanders. By John R. Newby. *With Illustrations.*

Italy. ——
Guide to Italy. London: Macmillan & Co., 1901. Size 7 × 5, pp. civ. and 356. *Maps and Plans. Price* 10*s. net. Presented by the Publishers.*

This will be noticed with other guides of the same series, the publication of which was commenced in 1901.

Italy. *Riv. G. Italiana* 8 (1901): 572–575. **Marinelli.**
Un plastico dei Colli Euganei ed alcune ricerche limnologiche del Dott. Stegagno. Del Olinto Marinelli. *With Illustration.*

Italy—Census. *Cosmos* 13 (1901): 49–55. **Raseri.**
La popolazione del Regno d'Italia secondo i risultati del Censimento generale eseguito il 9 febbraio 1901. Cenni del Dott. E. Raseri.

Italy—Parma. **Schütte.**
Die Lage von Parma und ihre Bedeutung im Wechsel der Zeiten. Eine Studie von Drd. Ludwig Schütte.—Festschrift des Geograph. Seminars der Universität Breslau zur Begrüssung des XIII. Deutschen Geographentages. Pp. 190–220. Breslau: 1901. Size 9½ × 6½. *Sketch-map and Plan.*

Montenegro. *M.G. Ges. Wien* 44 (1901): 140–165. **Hassert.**
Reise durch Montenegro im Sommer 1900. Von K. Hassert. *With Map.*

Norway. *G.Z.* 7 (1901): 642–645. **Richter.**
Neue Beiträge zur Morphologie von Norwegen. Von Prof. Dr. E. Richter.

Russia. **Baedeker.**
Russland. Handbuch für Reisende, von K. Baedeker. Fünfte Auflage. Leipzig: Karl Baedeker, 1901. Size 6½ × 4½, pp. l. and 478. *Maps and Plans. Price* 15*m.*

Russia. *C. Rd.* 133 (1901): 596–598. **Duparc and Pearce.**
Sur les roches éruptives du Tilai-Kamen (Oural). Note de MM. L. Duparc et F. Pearce.

Russia. **Guénin.**
Eugène Guénin. La Russie, Histoire, Geographie, Littérature. Paris: Hachette et Cie., 1901. Size 10½ × 7, pp. xii. and 360. *Illustrations. Price* 5*s.* 6*d. Presented by the Publishers.*

A sketch, of a popular character, of Russian history and geography, the latter consisting chiefly of extracts from the works of various travellers and writers.

Russia. *Rev. Scientifique* 16 (1901): 385–393. **Zaborowski.**
Origines des populations anciennes et actuelles de la Russie méridionale et du Caucase. Par M. Zaborowski.

Russia—Bibliography. ——
Bibliothèque Géologique de la Russie, 1897. Édition du Comité Géologique. St. Pétersbourg: Eggers et Cie., 1901. Size 10 × 6½, pp. iv. and 280.

Russia—Finland. **De Windt.**
Finland as it is. By Harry de Windt. London: John Murray, 1901. Size 8½ × 5½, pp. xii. and 316. *Map and Illustrations. Price* 9*s. net. Presented by the Publisher.*

Russia—Hydrography. ——
Report of the Chief Hydrographic Department for 1899. (In Russian.) St. Petersburg, 1900. Size 9½ × 6, pp. x. 436, and 24. *Maps.*

There are numerous maps showing the localities in which hydrographical work was done, and the positions of shipwrecks.

Russia—Finland. **Leclercq.**
Le conflit entre la Russie et la Finlande. Par Jules Leclercq. (Extrait de *La Revue Générale*, août—septembre 1901.) Bruxelles: Oscar Schepens et Cie., 1901. Size 10 × 6½, pp. 36. *Presented by the Author.*

Switzerland—Peat-mosses. **Neuweiler.**
Vierteljahrs. Naturforsch. Ges. Zürich 46 (1901): 35–93.
Beiträge zur Kenntnis schweizerischer Torfmoore. Von E. Neuweiler. *Plates.*

Turkey—Macedonia. *Questions Dipl. et Colon.* 12 (1901): 129–146. ———
La Macédoine et ses habitants. Par Testis. *With Map.*

Turkey—Macedonia. *Deutsche Rundschau G.* 23 (1901): 529–534. **Struck.**
Philippi. Von Ad. Struck. *With Illustrations.*

United Kingdom. *Geolog. Mag.* 8 (1901): 510–513. **Monckton.**
On the origin of the Gravel-Flats of Surrey and Berkshire. By H. W. Monckton.

The author considers that these gravels, though occurring as high above sea-level as 600 feet, are true river-deposits.

United Kingdom—Cheviots. *Geolog. Mag.* 8 (1901): 513–515. **Kendall and Muff.**
Evidences of Ancient Glacier-dammed Lakes in the Cheviots. By Percy F. Kendall and Herbert B. Muff.

Evidence of such lakes is to be found in the existence of a series of overflow channels. The authors consider it proved that while "foreign" ice was rising along the flanks of the Cheviots to 1000 feet, the spurs and lower ends of intervening valleys were free from native ice.

United Kingdom—London. **Aves.**
Philip's practical "Index" Guide to London: its Thoroughfares, Places of Amusement, Public Buildings, etc. With Complete Summary of Routes and Fares by Train, Tram, 'Bus, or Boat, arranged on an original plan. By W. O. Aves. London: G. Philip & Son, 1901. Size 7½ × 4½, pp. 152. *Map. Price* 1s. *Presented by the Publishers.*

The plan adopted is ingenious, and when once mastered should be of much assistance as a guide to the localities of and means of access to the various features of the metropolis. Each main thoroughfare has its own number, and its course is represented by a graphic method, with distances, gradients, side streets, railway stations, public buildings, etc. Railway, Omnibus, and Tram routes are shown in special sections.

United Kingdom—Rainfall. **Wallis and Mill.**
British Rainfall, 1900. On the Distribution of Rain over the British Isles during the year 1900, as observed at about 3500 stations in Great Britain and Ireland, with articles upon various branches of Rainfall work. Compiled by H. Sowerby Wallis and Hugh Robert Mill, D.SC., LL.D. London: E. Stanford, 1901. Size 9 × 5½, pp. 72 and 254. *Maps and Illustrations. Price* 10s.

The report on the position of the rainfall organization during 1900 states that additional observers are urgently needed in nearly all parts of Scotland and Ireland. Besides the usual full statistics, the volume contains articles by Dr. Mill on the Ilkley flood of July 12, and on the development of rainfall measurement in the last forty years.

United Kingdom—Tide Tables. **Harris and Havergal.**
Tide Tables for the British and Irish Ports, for the year 1902: also the times and heights of High Water at Full and Change for the principal places on the Globe. By Captain H. R. Harris and Commander A. Havergal. London: J. D. Potter. Size 10 × 6, pp. xi. and 262. *Price* 2s. *Presented by the Hydrographer, Admiralty.*

ASIA.

China—Liao-Tung. *B.S.G. Com. Paris* 22 (1900): 621–625. **Bleton.**
La presqu' île de Liao-Toung. Par Henri Bleton.

China—Railway. ———
China, No. 7 (1901). Correspondence respecting the Imperial Railway of North China. London: Eyre & Spottiswoode, 1901. Size 13 × 8½, pp. xiv. and 128. *Price* 1s. 2d.

China—Tientsin. *Tour du Monde* 7 (1901): 481–492. **Laguérie.**
Tien-tsin après la défaite des Boxeurs. Par M. Villetard de Laguérie. *With Illustrations.*

China—Trade. *B.S.G. Com. Paris* 22 (1900): 575–620. **Frandon.**
Du développement possible du Commerce entre la France et la Chine. Par M. E. Frandon. *With Map.*

China—Yangtse. *J.S. Arts* 49 (1901): 792–795. **Mobsby.**
Steam Traffic and Trade on the Upper Yangtse.

The writer considers steam traffic impracticable between Ichang and Wan-hsien, but recommends its introduction between the latter and Suifu on the Yangtse and Chiating-fu on the Min.

China Sea—Directory. ——
Supplement 1901, relating to China Sea Directory, Vol ii., Fourth Edition, 1899. (Corrected to May 4, 1901.) London: D. Potter, 1901. Size 9½ × 6, pp. 28. *Price 4d. Presented by the Hydrographer, Admiralty.*

Chinese Empire—Gobi. **Verwilghen.**
Missions en Chine et au Congo 13 (1901): 73–76, 97–108, 121–131, 145–151.
A Travers le Desert du Gobi. Relation du Voyage des quinze missionnaires expulses du Vicariat des Ortos. Par le R. P. Verwilghen. *With Illustrations.*

Chinese Empire—Tibet. **Rijnhart.**
With the Tibetans in Tent and Temple. Narrative of Four Years' Residence on the Tibetan Border, and of a Journey into the Far Interior. By Susie Carson Rijnhart, M.D. Edinburgh and London: Oliphant, Anderson, & Ferrier, 1901. Size 8 × 5½, pp. 406. *Illustrations. Price 6s. Presented by the Publishers.*

The story of Mr. and Mrs. Rijnhart's adventurous wanderings, the treacherous murder of the former, and the return of the latter amid incredible hardships, has already been recorded in the *Journal.* This volume contains a full account of these thrilling occurrences, preceded by a record of previous work on the Tibetan border, which, among other experiences, brought Mr. and Mrs. Rijnhart in contact with the Dungans at the time of the last Mohammedan revolt.

Eastern Asia. *B.S.G. Lille* 36 (1901): 157–184. **Guillot.**
Les Européens dans l'Asie Orientale. Par E. Guillot. *With Map.*

French Indo-China—Annam. *Rev. Scientifique* 16 (1901): 557–561. **d'Enjoy.**
Le pays d'Annam. Par M. Paul d'Enjoy.

Deals with the history and dynasties of the country.

French Indo-China—Annam. *B.S.G. Com. Paris* 22 (1900): 626–636. **Saugy.**
Les mines d'or de Bong-Miu (Annam). Par L. de Saugy.

French Indo-China—Laos. ——
A travers le Monde, Tour du Monde 7 (1901): 337–339.
Les tribus Khas du Bas-Laos. *With Map and Illustrations.*

India—Geological Survey. **Griesbach.**
General Report on the work carried on by the Geological Survey of India for the period from the 1st April, 1900, to the 31st March, 1901, under the direction of C. L. Griesbach. Calcutta, 1901. Size 10½ × 7, pp. ii. and 36. *Presented by the Geological Survey of India.*

India—Himalayas. *Blackwood's Mag.* 170 (1901): 206–217. **Ronaldshay.**
Across the Himalayas in Mid-Winter. By the Earl of Ronaldshay.

The journey was made in January, 1900, from Bunji on the Upper Indus to Srinagar.

India—Railways. ——
East India (Railways). Administration Report on the Railways in India for the Calendar Year 1900. London: Eyre & Spottiswoode, 1901. Size 13½ × 8½, pp. 496. *Map and Diagrams. Price 4s. 8½d.*

Contains a large amount of useful information respecting the Indian Railways, the increase in mileage of which during 1900 was 1237 miles. (See note on p. 213.)

India—Son Valley. **Oldham, Datta, and Vredenburg.**
Mem. Geolog. Surv. India 31 (Pt. i.) (1901): pp. 178.
Geology of the Son Valley in the Rewah States, and of parts of the Adjoining Districts of Jabalpur and Mirzapur. By R. D. Oldham, P. N. Datta, and E. Vredenburg. *With Map and Plates.*

This was noticed in January in the Monthly Record.

Indian Ocean—Seychelles. **Sweet-Escott.**
Seychelles. Report for 1901. Colonial Reports, Annual No. 333, 1901. Size 9½ × 6, pp. 48. *Price* 2½*d.*

In thirty-six years the revenue has increased more than sevenfold, and almost invariably exceeds the expenditure. A falling off in exports is due to the small vanilla crop of 1899–1900.

Japan, etc. **Brandt.**
Dreiunddreissig Jahre in Ost-Asien. Erinnerungen eines deutschen Diplomaten. Von M. von Brandt. Band ii. Leipzig: Georg Wigand, 1901. Size 9 × 6, pp. xvi. and 386. *Frontispiece.*

This volume possesses a still higher interest than the opening volume of the work, noticed in the *Journal* for February, 1901 (p. 208). It describes the important occurrences in Japan in 1863–1868, the years in which the endeavour of the Conservative party to keep foreigners at arm's length was finally put to the test. The writer draws attention to the analogies between these events and recent occurrences in China, showing that the comparatively little attention paid to the former in Europe was due to the imperfection of then existing means of communication. The book supplies a valuable means of comparison between the policies adopted in the two cases. One chapter deals with visits to America in 1871 and 1872.

Japan. *J. Manchester G.S.* 17 (1901): 124–132. **Heywood.**
A Holiday in Japan. By the Rev. J. W. Heywood.

On a walking tour among the mountains of the Myanoshita, Hakone, and Nikko districts.

Japan—Earthquakes. **Yamasaki.**
Erdbebenforschung in Japan. Vortrag gehalten am Geographenabend an der Wiener Universität. Von Dr. N. Yamasaki. Laibach, 1901. Size 10 × 6¾, pp. 12. *Diagrams. Presented by the Author.*

Japan—Fish Fauna. *Science* 14 (1901): 545–567, 936. **Jordan.**
The Fish Fauna of Japan, with observations on the Geographical Distribution of Fishes. By President David Starr Jordan.

Malay Archipelago—Borneo. **Hewett.**
Trade of Sarawak for the year 1900. Foreign Office, Annual No. 2711, 1901. Size 9½ × 6, pp. 14. *Price* 1*d.*

Malay Archipelago—Borneo. *Mission Field* 46 (1901): 323–331. **Sharp.**
Borneo—its Natives, Immigrants, and European Enterprises. By the Ven. Arthur F. Sharp. *With Illustrations.*

Persia. **Finn.**
Apuntes de un viaje en Persia. Conferencia dada en la Sociedad de Ciencias fisicas de Málaga, por su socio Alexander Finn. Malaga, 1901. Size 8¾ × 5¾, pp. 26.

Russia—Caucasus. **Landesen.**
XVII.—XIX. Jahresb. (1898–1900) *Württemberg. V. Handelsg.* (1901): 32–64.
Reiseskizzen aus Transkaukasien. Von W. v. Landesen.

Russia—Caucasus. **Stevens.**
Trade of Batoum and District for the year 1900. Foreign Office, Annual No. 2623, 1901. Size 9¾ × 6¾, pp. 32. *Price* 2*d.*

Russia—Siberia—Altai. ———
Sketch of Immigration to the Altai District in 1884–1898. (In Russian.) Barnaul, 1900. Size 9½ × 6½, pp. 40, 46, and 94.

Russia—Siberia—Railway. *J. Manchester G.S.* 17 (1901): 37–45. **Brice.**
The Great Siberian Railroad. By Arthur Montefiore Brice. *With Map.*

Turkey—Bussorah. **Wratislaw.**
Trade of Bussorah for the year 1900. Foreign Office, Annual No. 2712, 1901. Size 9½ × 6, pp. 6. *Price* ½*d.*

Turkey—Karpathos. *B.S.R. Belge G.* 25 (1901): 237–288. **Hauttecœur.**
L'Ile de Karpathos. Par Henry Hauttecœur. *With Map.*

Turkey—Koweit. *B. Comité l'Asie Française* 1 (1901): 270–272. **Peyerimhoff.**
L'Affaire de Koueït. Par Henri de Peyerimhoff. *With Map.*

Turkey—Palestine. **Nies.**
Palestine Exploration Fund, Quarterly Statement (1901): 362–368.
Notes on a Cross Jordan Trip made October 23 to November 7, 1899. By the Rev. James B. Nies, PH.D.

Contains notes on ruins and inscriptions.

Turkey—Syria. **Schulz.**
XVII.—XIX. Jahresb. (1898–1900) *Württemburg. V. Handelsg.* (1901): 65–145.
Syriens Rolle im Welthandel. Geographische Studie. Von Dr. Schulz. *Maps.*

Turkey—Syria. **Smith.**
Palestine Exploration Fund, Quarterly Statement (1901): 340–361.
Notes of a Journey through Hauran, with Inscriptions found by the way. By Prof. G. A. Smith, D.D. *With Illustrations.*

Among new discoveries was that of an Egyptian monument—only the second so far found in Hauran—which is referred to the reign of Sety I.

Western Asia. *Rendiconti R.A. Lincei* 10 (1901): 149–171. **Corvatta.**
Divisione amministrativa dell' Impero dei Seleucidi. Nota della dott. Adalgisa Corvatta.

AFRICA.

Central Africa. *Church Miss. Intelligencer* 52 (1901): 758–761. **Crabtree.**
Concerning a Former Roman Catholic Mission on the Upper Nile. A Translation. By the Rev. W. A. Crabtree.

This paper, taken from Mitterrutzner's Bari Grammar, gives an account of the Catholic mission to the upper Nile under Ryllo and Knoblecher, commenced in 1848.

Central Africa. *Geolog. Mag.* 8 (1901): 362–370. **Fergusson.**
Geological Notes from Tanganyika Northwards. By Malcolm Fergusson. *Maps.*

Summary of the geological results of the Moore Expedition.

Central Africa—Railways. *Deutsche Kolonialzeitung* 18 (1901): 409–410. **Vohsen.**
Die belgischen Eisenbahn-Projekte am oberen Kongo und die deutsch-ostafrikanische Seenbahn. Von Konsul E. Vohsen. *With Map.*

The writer thinks that if a German railway to Tanganyika becomes an accomplished fact, the new Congo State lines will chiefly benefit German East Africa.

Congo State and Bahr-el-Ghazal. *Nineteenth Century* 50 (1901): 202–213. **Morel.**
The Congo State and the Bahr-el-Ghazal. By Edmund P. Morel. *With Map.*

On the claim by the Congo State to the Bahr-el-Ghazal territory.

East Africa—Geology. **Künzli.**
Vierteljahrs. Naturforsch. Ges. Zürich 46 (1901): 128–172.
Die petrographische Ausbeute der Schöller'schen Expedition in Aequatorial-Ostafrika (Massailand). Von Emil Künzli.

Egypt. ———
Ministry of Public Works. A List of Publications, Maps, and Plans published by the Public Works Ministry up to June 30, 1901. Cairo, 1901. Size 9½ × 6½, pp. 26.

Egypt. **Garstin.**
Public Works Ministry, Report upon the Administration of the Public Works Department for 1900. By Sir W. E. Garstin, K.C.M.G. With Reports by the Officers in charge of the several Branches of the Administration. Cairo, 1901. Size 10½ × 7½, pp. 354. *Plates. Presented by the Author.*

This will be noticed elsewhere.

Egypt—Meteorology. ———
A Report on the Meteorological Observations made at the Abbassia Observatory, Cairo, during the years 1898 and 1899, together with the Mean Values derived from the Observations of the previous thirty years, also some Magnetic Observations. Cairo, 1900. Size 11 × 9, pp. 326. *Diagrams. Presented by the Director-General, Survey Department, Cairo.*

Egypt—Siva Oasis. **Hohler.**
Report on the Oasis of Siva. By T. B. Hohler. Cairo, 1900. Size 7½ × 11, pp. 50. *Illustrations. Presented by the Author.*

Based on a journey made in July, 1900. M. Maspero adds notes on the ancient

history of the oasis and on the origin of the water-cisterns along the coast of Marmarica.

Eritrea. *Cosmos* 13 (1901): 5–29, 56–69. **Cora.**
Arailèe e Golima, il paese degli 'Afâr tra Assab e l'Aussa. Ricerche e considerazioni di Guido Cora. *With Map.*

Eritrea. *L'Esplorazione Com.* 16 (1901): 249–252, 265–269. **Parazzoli.**
Sulle odierne Condizioni dell' Eritrea. A. Parazzoli.

French Congo. *Mouvement G.* 18 (1901): 535–538. **Séguin.**
Voyage d'exploration dans l'intérieur du Kuango. Par M. Séguin. *With Map.*

The Kuango here alluded to is not the important tributary of the Congo of that name, but an affluent of the Ubangi in 5° N. lat. (Cf. note in Monthly Record, p. 89.)

French Congo—Ogowe. *B.S.G. Lille* 36 (1901): 225–256. **Avelot.**
Dans la boucle de l'Ogôoué. Par le Lieut. Avelot. *With Map.*

The writer carried out surveys in 1899–1900, for the purpose of delimiting the spheres of the chief commercial companies to which concessions have been granted.

German East Africa. *M. Deutsch. Schutzgeb.* 14 (1901): 172–183. **Meyer.**
Von Utengule nach Kipembabwe, Mwendo, Ibungu, Inyika und zurück. Von Missionar Th. Meyer. *With Map.*

German East Africa. *M. Deutsch. Schutzgeb.* 14 (1901): 183–193. **Schlobach.**
Die Volksstämme der deutschen Ostküste des Victoria-Nyansa. Von Hauptmann Schlobach. *With Map.*

German South-West Africa. *Deutsche Kolonialzeitung* 18 (1901): 433–435. **Dove.**
Swakopmund einst und jetzt. Von Prof. Dr. K. Dove. *With Illustrations.*

Ivory Coast. **Cassel.**
Renseignements Colon., Comité l'Afrique Française, No. 5 (1901): 100–109.
La Haute Côte d'Ivoire occidentale. Par M. Van Cassel. *With Map.*

The writer took part in the Woelffel mission (*Journal*, vol. xvii. p. 306).

Kamerun. *M. Deutsch. Schutzgeb.* 14 (1901): 144–166. **Schimmelpfennig.**
Bericht über die Expedition des Hauptmanns v. Schimmelpfennig von Ngutte II. nach Yabassi. *With Map.*

This was referred to in the *Journal* for December, p. 623.

Kamerun. *Beiträge Kolonialpolitik* 3 (1901–1902): 149–172, 193–210. **Seidel.**
Das Bakwirivolk in Kamerun. Von A. Seidel.

Nigeria—Benin. **Luschan.**
XVII.—XIX. Jahresb. (1898–1900) *Württemberg. V. Handelsg.* (1901): 146–239.
Die Karl Knorrsche Sammlung von Benin-Altertümern. Von F. V. Luschan. *With Plates.*

Portuguese East Africa. **Belcher.**
Trade of Beira for the year 1900. Foreign Office, Annual No. 2627, 1901. Size 10 × 6, pp. 16. *Price* 1*d.*

Portuguese East Africa—Inhambane. **Parminter.**
Trade of Inhambane for the year 1900. Foreign Office, Annual No. 2630, 1901. Size 9½ × 6, pp. 12. *Price* 1*d.*

Sahara. *B.S.G. Marseille* 25 (1901): 136–156. **Lahache.**
L'eau dans le Sahara. Par M. J. Lahache.

The writer considers that the system of artesian borings is capable of great extension.

Sahara. *Rev. Scientifique* 16 (1901): 489–492, 516–523. **Simian and Huguet.**
La question transsaharienne (1899–1901). Par MM. Simian et Huguet.

The writers favour a line running south-west from Algeria (Igli) to Kayes, on the Senegal.

Sahara—Tidikelt. **Rimbaud.**
Renseignements Colon., Comité l'Afrique Française, No. 5 (1901): 97–100.
Les Tifinar' de la Gara des Chorfa. Par M. Rimbaud. *With Illustrations.*

On inscriptions found to the east of the Shorfa group of oases, which, though more recent than the Libyan inscriptions of Northern Algeria, present the same characters

and show that their authors must have had a common origin with the Berbers and Tuareg, the latter of whom still use the same phonetic writing.

South-West Africa—Walfish Bay. **Waldron.**
T.S. African Philosoph. S. 11 (1901): 185–188.
On the Appearance and Disappearance of a Mud Island at Walfish Bay. By F. W. Waldron. *With Chart and Plates.*

The island was just seen on June 1, 1900, and had disappeared by June 7.

Sudan. ——
Notes for Travellers and Sportsmen in the Sudan. October, 1901. Cairo. Size 11 × 8, pp. 24. *Price* 1*s.*

Tanganyika—Fishes. *T. Zoolog. S.* 16 (1901): 137–160. **Boulenger.**
Third Contribution to the Ichthyology of Lake Tanganyika. Report on the Collection of Fishes made by Mr. J. E. S. Moore in Lakes Tanganyika and Kivu during his Second Expedition, 1899–1900. By G. A. Boulenger. *With Plates.*

Tunis—Irrigation. *B.S.G. Com. Bordeaux* 27 (1901): 278–283. **Wolfrom.**
L'Utilisation des travaux hydrauliques des Romains en Tunisie. Par Gustave Wolfrom.

The writer recommends the restoration of old Roman works.

Tunis—Railways. *Questions Dipl. et Colon.* 12 (1901): 449–459. **Pasquier.**
Les chemins de fer tunisiens devant le Parlement. Par H. Pasquier. *Maps.*

Discusses rival schemes for the development of the Tunisian railway system.

NORTH AMERICA.

British North America—Newfoundland. **Harrisse.**
Découverte et Évolution Cartographique de Terre-Neuve et des pays circonvoisins 1497—1501—1769. Essais de Géographie historique et documentaire. Par Henry Harrisse. Paris: H. Welter. London: H. Stevens, Son, & Stiles, 1900. Size 11 × 9, pp. iv., lxxii., and 420. *Facsimile Maps.*

This will be reviewed elsewhere.

Canada—Geological Survey Report. — —
Geological Survey of Canada. Annual Report (New Series). Volume xi. Reports A, D, F, G, J, L, M, R, S, 1898. Ottawa, 1901. Size 10 × 6½. *Maps and Illustrations. Presented by the Geological Survey of Canada.*

As usual this report contains a large amount of information on the physical geography as well as the geology of little-known outlying parts of Canada.

Canada—Ontario. **O'Sullivan.**
Second Report of Progress of Exploration in the Country between Lake St. John and James Bay, including the region of Lake Mistassini and the basins of the great Nottaway and Rupert Rivers, together with a key-plan to accompany remarks on the different proposed railways between Quebec and James Bay. Made under instructions from the Department of Colonization and Mines, Quebec, by Henry O'Sullivan. Quebec, 1901. Size 10 × 6½, pp. 82. *Maps and Illustrations. Presented by Colonel G. E. Church.*

This was referred to in January in the Monthly Record.

Mexico. *J. Franklin I.* 152 (1901): 241–256. **Haines.**
Remarks on the Earthquake in the State of Colima, Mexico, January 19, 1900. By C. W. Haines.

Mexico. *Queensland G.J.* 16 (1900–1901): 91–112. **Thomson.**
An Account of Lord Lamington's Travels in Mexico, 1887. By J. P. Thomson. *Also separate copy, presented by the Author.*

Mexico. **Tweedie.**
Mexico as I saw it. By Mrs. Alec Tweedie. London: Hurst & Blackett, 1901. Size 9½ × 7, pp. xii. and 472. *Map and Illustrations. Price* 21*s. net. Presented by the Publishers.*

Deals largely with the ordinary incidents of travel in Mexico, and sketches of the everyday life of the people.

Mexico—Tehuantepec Railway. *Fortnightly Rev.* 70 (1901): 271–280. **Tweedie.**
The Isthmus of Tehuantepec Railway. By Mrs. Alec Tweedie.

A recent arrangement between the Mexican Government and Messrs. S. Pearson

& Son provides for the construction of deep-water ports at both ends of the railway, and for the working of the latter by the company for fifty years.

North America—Historical. **Biggar.**

The Early Trading Companies of New France. A Contribution to the History of Commerce and Discovery in North America. By H. P. Biggar, B.A., University of Toronto Library, 1901. Size 11 × 7½, pp. xii. and 308. *Map. Presented by the University of Toronto.*

A valuable historical study which will be noticed elsewhere.

United States. ——

The Center of Population and its Median Point. (Twelfth Census of the United States. Census Bulletin, No. 62. April 30, 1901.) Washington, D.C. Size 11½ × 9, pp. 4. *Maps.*

See note in *Journal*, vol. xviii. p. 92.

United States—Arkansas Valley. *J. Geology* **9** (1901): 486–490. **Keyes.**

Composite Genesis of the Arkansas Valley through the Ozark Highlands. By Charles R. Keyes.

The trough of the Arkansas valley is shown to be both topographical and structural in origin.

United States—Chicago. **Cowles.**

The Physiographic Ecology of Chicago and Vicinity: a study of the Origin, Development, and Classification of Plant Societies. Contributions from the Hull Botanical Laboratory, XXIV. By Henry Chandler Cowles. (Reprinted from the *Botanical Gazette*, vol. xxxi., February and March, 1901.) Size 10 × 7, pp. [74]. *Illustrations. Presented by the Author.*

A careful study on the lines lately much in vogue in the United States.

United States—Connecticut. *J. Geology* **9** (1901): 469–485. **Hobbs.**

The River System of Connecticut. By W. H. Hobbs. *With Maps.*

Traces the connection between the river system of Connecticut and the joint or fault-system of the region. The subject is more fully dealt with in the latest annual report of the U.S. Geological Survey. (See note, *ante*, p. 91.)

United States—Ohio. *Science* **14** (1901): 534-535. **Miller.**

Preglacial Drainage in South-Western Ohio. By Arthur M. Miller. *Sketch-map.*

The writer contests the idea lately put forward that the Licking and Kentucky rivers once flowed north.

CENTRAL AND SOUTH AMERICA.

Anguilla, etc. *Quarterly J. Geolog. S.* **57** (1901): 520–533. **Spencer.**

On the Geological and Physical Development of Anguilla, St. Martin, St. Bartholomew, and Sombrero. By Prof. J. W. W. Spencer.

Antigua. *Quarterly J. Geolog. S.* **57** (1901): 490–505. **Spencer.**

On the Geological and Physical Development of Antigua. By Prof. J. W. W. Spencer. *With Map.*

Argentine Republic—Rio Santa Cruz. ——

Ministerio de Marina. Relevamiento Hidrográfico del Rio Santa Cruz Informe General. Por Alfredo R. Iglesias, Teniente de fragata. Buenos Aires, 1901. Size 11 × 7½, pp. 148. *Map and Illustrations. Presented by the Argentine Government.*

This report gives the results of the careful survey of the Rio Santa Cruz, executed between December, 1899, and January, 1900. (See note, *ante*, p. 94.)

Bahamas. **Churchill.**

Bahamas. Report for 1900. Colonial Reports, Annual No. 327, 1901. Size 9½ × 6, pp. 44. *Price 2½d.*

Bolivia. *Globus* **80** (1901): 193-194. ——

Das bolivianische Territorium Acre und Seine Revolution.

The inhabitants of the district of the Rio Acre, Brazilian by birth, but settled on Bolivian territory, lately declared their territory an independent republic. Representations to Brazil having had no positive result, the matter was taken up by the Bolivian Government, which despatched three expeditions against the revolutionists. These, though costly in lives, secured the nominal recognition of Bolivian authority.

Bolivia. *B.S.G. La Paz* 3 (1901): 269-282. **Ballesteros.**
La Provincia de Caupolicán y el Decreto Supremo sobre la creación del Territorio Nacional de Colonias. Discursos parlamentarios. Por Sixto L. Ballesteros.

On the proceedings in the Bolivian Parliament for the creation of the new territory of Colonias.

Brazil—Ceara. *Rev. Trim. I. Ceará* 15 (1901): 153-288. **Bezerra.**
Algumas origens do Ceará. Por Antonio Bezerra.

Brazil—Ceara. *Rev. Trim. I. Ceará* 15 (1901): 311-318. **Mendes and Sampaio.**
Lingua Indigena—O nome Ceará. Por Cunha Mendes, Theodoro Sampaio e João Mendes Junior.

Brazil—Italian Settlers. **Pio.**
Gli Italiani nel Nord dello Stato di Santa Caterina. Rapporto del cav. Gherardo (dei principi) Pio di Savoja. (Boll. Ministero Affari Esteri, Settembre 1901.) Roma, 1901. Size 9 × 6, pp. 36.

Central and South America. **Preuss.**
Kolonial-Wirtschaftliches Komitee. Expedition nach Central- und Südamerika. Dr. Paul Preuss. 1899–1900. Berlin, 1901. Size 10 × 6½, pp. xii. and 452. *Illustrations. Price* 20 *marks. Presented by the Committee.*

The author is well known as the energetic director of the Experimental Garden at Victoria, Kamerun. He undertook a journey to South America for the purpose of studying the plantation systems of the West Indies, Central and South America, and applying the experience gained to the improvement of agriculture in the German Protectorates. While thus somewhat technical in aim, the book supplies valuable information, not only on tropical agriculture, but on the subject of botanical distribution in the countries visited and the general relations of the flora.

Dutch Guiana. *Tijds. K. Ned. Aard. Genoots. Amsterdam* 18 (1901): 963-968. ———
Suriname Expeditie. *With Map.*

See note in *Journal* for December, 1901, p. 625.

French Guiana. **Brousseau.**
Georges Brousseau. Les Richesses de la Guyane Française et de l'ancien Contesté Franco-Brésilien. Paris, Société d'Éditions Scientifiques, 1901. Size 11 × 7½, pp. viii. and 248. *Map and Illustrations. Price* 10 *francs.*

A useful account of the nature and resources of French Guiana and the territory lately in dispute between it and the mouth of the Amazon. The author's travels in the latter have materially added to our knowledge. Especial prominence is given, in addition to the agricultural resources, to the forest wealth of the colony, which the writer believes to be capable of development. A list is given of all the woods most abundant in French Guiana, which, however has been insufficiently revised, many misprints occurring in the botanical names of the trees.

Guadeloupe. *Quarterly J. Geolog. S.* 57 (1901): 506-519. **Spencer.**
On the Geological and Physical Development of Guadeloupe. By Prof. J. W. W. Spencer.

Peru. **Seebee.**
Travelling Impressions in, and Notes on, Peru. By Felix Seebee. London: Elliot Stock, 1901. Size 8 × 5, pp. 196. *Map. Price* 3*s.* 6*d. Presented by the Publisher.*

This unpretentious little work displays a considerable power of description on the part of the author, who lived in Peru for some years previous to and including the period of the war with Chili. It is written in a simple but telling style, and gives some insight into the everyday life of the people, both in the towns and in the remoter regions of the Andes.

St. Christopher. *Quarterly J. Geolog. S.* 57 (1901): 534-544. **Spencer.**
On the Geological and Physical Development of the St. Christopher Chain and Saba Banks. By Prof. J. W. W. Spencer.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia. *Queensland G.J.* 16 (1900-1901): 1-25. **Thomson.**
The Geographical Evolution of the Australian Continent. By J. P. Thomson. *With Sketch-maps and Illustrations. Also separate copy, presented by the Author.*

Australia. *J. Manchester G.S.* 17 (1901): 111-123. **Wragge.**
The Snowy Ranges of Australia, Mount Kosciusko and its Observatory. By Clement Wragge.

Australia—Exploration. *Travel* 6 (1901): 209-213. **Bryant.**
Glimpses of Australian Exploration. By the Rev. Joseph Bryant. *With Illustrations.*

British New Guinea. *Queensland G.J.* 16 (1900-1901): 63-68. **Winter.**
Notes on a Government Expedition, under Dr. J. A. Blayney, Captain J. R. Barton, and Mr. A. E. English, to the Main Range, British New Guinea. By Sir Francis P. Winter, Kt. *With Map.*

The party reached a height of 4500 on the main divide north of Cloudy bay, and crossed to the headwaters of the Musa river (see note, *ante*, p. 95).

Gilbert and Ellice Islands. **Campbell.**
Gilbert and Ellice Islands. Report for 1896–1900. Colonial Reports, Miscellaneous, No. 17, 1901. Size $9\frac{3}{4} \times 6$, pp. 10. *Price 1d.*

Kerguelen Island. *A travers le Monde, Tour du Monde* 7 (1901): 277-278. ———
Les îles Kerguelen —Centre scientifique de l'expédition allemande—Futur lieu de déportation. *With Map.*

Marianne Islands—Rota. *M. Deutsch. Schutzgeb.* 14 (1901): 194-204. **Fritz.**
Bericht über die Insel Rota (Marianen). Von Bezirksamtmann Fritz. *With Illustrations.*

New Caledonia. **Haggard.**
Trade of New Caledonia for the year 1900. Foreign Office, Annual No. 2626, 1901. Size 10×6, pp. 12. *Price 1d.*

New South Wales. **Jaquet.**
The Iron Ore Deposits of New South Wales. By J. B. Jaquet. (Memoirs of the Geological Survey of New South Wales, Geology, No. 2.) Sydney, 1901. Size 12×10, pp. xiv. and 186. *Maps, Plates, and Sections. Presented by the Geological Survey of New South Wales.*

This was noticed in the Monthly Record for January (p. 94).

Pacific. **Hall and Osborne.**
Sunshine and Surf. A Year's Wanderings in the South Seas. By Douglas B. Hall and Lord Albert Osborne. London: A. and C. Black, 1901. Size $8\frac{1}{2} \times 5\frac{1}{2}$, pp. xiv. and 320. *Map and Illustrations. Price 12s. 6d. Presented by the Publishers.*

A pleasantly written popular account of travel in the Pacific. The route took in, among other groups, the Marquesas, Tahiti, the Cook islands, Fiji, and Samoa, and although no pretence at scientific observation was made, the information, at first hand, as to the present state of affairs and the manners and customs of the natives in the several groups is of considerable interest.

Queensland. *Queensland G.J.* 16 (1900-1901): 50-62. **Forbes.**
Reminiscences of the Early Days of the present Colony of Queensland. By David Forbes.

Queensland. *Queensland G.J.* 16 (1900-1901): 42-49. **Maguire.**
Panoramas of Nature as viewed from Picturesque Plateaux in Southern Queensland. By H. R. Maguire.

Queensland—Brisbane River. *Queensland G.J.* 16 (1900-1901): 26-34. **Gregory.**
On the Mitigation of Floods in the Brisbane river. By the Hon. A. C. Gregory, C.M.G.

A reply to criticism by Colonel Pennycuik.

Samoa—Canoes. *Globus* 80 (1901): 167-173. **Thilenius.**
Die Fahrzeuge der Samoaner. Von Prof. Dr. Thilenius. *With Illustrations.*

South Australia. *T.R.S. South Australia* 25 (1901): 45-47. **Chewings.**
Notes on Glacial Beds of Cambrian Age in Far North of South Australia. By Chas. Chewings, PH.D.

South Australia. *T.R.S. South Australia* 25 (1901): 10-13. **Howchin.**
Preliminary Note on the Existence of Glacial Beds of Cambrian Age in South Australia. By Walter Howchin.

The writer has discovered beds of "till," the age of which, though at present a matter of inference only, cannot, he thinks, be later than the Cambrian.

South Australia. *T.R.S. South Australia* 25 (1901): 54–62. **Howchin.**
Notes on the Extinct Volcanoes of Mount Gambier and Mount Schank, South Australia. By Walter Howchin.

South Australia—Northern Territory. *Queensland G J.* 16 (1900–1901): 69–90. **Mathews.**
Ethnological Notes on the Aboriginal Tribes of the Northern Territory. By R. H. Mathews.

South Australia—Yorke Peninsula. *T.R.S. South Australia* 25 (1901): 1–9. **Howchin.**
Suggestions on the Origin of the Salt Lagoons of Southern Yorke peninsula. By Walter Howchin.

The writer suggests chemical solution as the agency to which the origin of the lagoons was due.

Torres Straits and New Guinea. ———
Reports of the Cambridge Anthropological Expedition to Torres Straits. Volume ii. Physiology and Psychology. Part i. Introduction and Vision. Cambridge: University Press, 1901. Size 11¼ × 9, pp. vi. and 140. *Maps and Illustrations. Price 9s. net. Presented by the Publishers.*

The complete set of reports on the scientific results of the Cambridge Expedition to Torres straits will form six volumes, devoted to the following subjects: Physical Anthropology, Physiology and Psychology, Linguistics, Technology, Sociology, and Religion, the general results being summarized in the last volume. The above is the first part which has appeared.

POLAR REGIONS.

Antarctic. **Neumayer.**
Auf zum Südpol! 45 Jahre Wirkens zur Förderung der Erforschung der Südpolar-Region 1855–1900. Von Prof. Dr. Georg von Neumayer. Berlin: Vita, Deutsches Verlagshaus (Felix Heinemann), 1901. Size 10 × 8, pp. xvi. and 486. *Portrait and Maps.*

This will be specially noticed.

Arctic. *Ann. Hydrographie* 29 (1901): 414–425, 445–457. **Bauendahl.**
Aus den wissenschaftlichen Ergebnissen der Polarfahrt des "Matador" unter Führung des Kapt.-Leut. a. D. Oskar Bauendahl, Herbst und Winter 1900–1901.

Deals with ice-conditions, meteorology, etc.

Polar Work. *J. Manchester G.S.* 17 (1901): 89–110. **Kœttlitz.**
Polar Work: What it is, why it should be done, and what is still to be done there, etc. By Dr. Reginald Kœttlitz. *With Illustrations.*

It is to be imagined that the author's absence with the Antarctic Expedition is responsible for the grammar in the above title.

MATHEMATICAL GEOGRAPHY.

Map Projections. **Close.**
A Sketch of the Subject of Map Projections. By Major C. F. Close, C.M.G. London: printed by Harrison & Sons, 1901. Size 8½ × 5½, pp. 40. *Diagrams. Presented by the Intelligence Division, War Office.*

This was noticed in the *Journal* for January (p. 79).

Mathematical Geography. *Vierteljahrshefte G. Unterricht* 1 (1901): 8–17. **Geissler.**
Die mathematische Geographie in ihrer Mittelstellung als empirische und mathematische Wissenschaft. Von Dr. Kurt Geissler.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Bio-geography—Camel. *Globus* 80 (1901): 188–189. **Nehring.**
Ein fossiles Kamel aus Südrussland, nebst Bemerkungen über die Heimat der Kamele. Von Prof. Dr. A. Nehring. *With Illustration.*

Cosmogony. *Naturw. Wochenschrift* 16 (1901): 441–446. **Engelbrethsen.**
Die erste Entwickelung unserer Erde. Nach P. Engelbrethsen.

Geological Time. *Geolog. Mag.* 8 (1901): 344–350, 504–506. **Joly.**
The Circulation of Salt and Geological Time. By Prof. J. Joly.

Meteorology—Methods. *Symons's Meteorolog. Mag.* 36 (1901): 125–128. **Mill.**
Meteorology on the British Antarctic Expedition.

Ocean Depths. ———
List of Oceanic Depths and Serial Temperature Observations received at the Admiralty during the year 1900, from H.M. Surveying Ships, Indian Marine Survey, and British Submarine Telegraph Companies. London: J. D. Potter, 1901. Size 13 × 8½, pp. 34. *Price* 4s.

Oceanography. **Giberne.**
The Mighty Deep and what we know of it. By Agnes Giberne. London: C. Arthur Pearson, 1902 [1901]. Size 8 × 5½, pp. xii. and 290. *Illustrations. Price* 5s. *Presented by the Author.*

A popular account of oceanic phenomena.

Oceans. *Mém. Couronnés A.R. Belgique* 57 (1898–99), 1–14. **De Windt.**
Sur les distances moyennes à la côte dans les océans. Par Jean De Windt.

This was noticed in the *Journal* on its appearance as a reprint in 1899 (vol. xiii. p. 666).

Physical Geography. **Dryer.**
Lessons in Physical Geography. By Charles R. Dryer. New York: American Book Company, 1901. Size 7½ × 5, pp. 430. *Illustrations.*

This will be specially noticed.

Physiography. **Morgan.**
Advanced Physiography. By Alex. Morgan. London: Longmans, Green & Co., 1901. Size 7½ × 5, pp. viii. and 408. *Illustrations. Price* 4s. 6*d.*

Supplements the elementary treatise previously written by the same author. Physiography is understood in the sense applied to the word in the South Kensington syllabus.

Underground Temperature. *Geolog. Mag.* 8 (1901): 502–504. **Sollas.**
Rate of Increase of Underground Temperature. By Prof. W. J. Sollas, LL.D., etc.

Waterfalls. **Sturm.**
Die Entstehung der Wasserfälle. Von Dr. Friedrich Sturm.—Festschrift des Geograph. Seminars der Universität Breslau zur Begrüssung des XIII. Deutschen Geographentages, pp. 122–132. Breslau, 1901. Size 9½ × 6½.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. **Marcus.**
Oasen und Inseln. Ein Kulturgeographischer Vergleich. Von Willy Marcus. Festschrift des Geograph. Seminars der Universität Breslau zur Begrüssung des XIII. Deutschen Geographentages, pp. 65–81. Breslau, 1901. Size 9½ × 6½.

Commercial Geography—Gold. *Deutsche Rundschau G.* 23 (1901): 569–570. ———
Die Verbreitung des Goldes auf der Erde. *With Map.*

Commercial Geography. *J. Franklin I.* 152 (1901): 179-200. **Haupt.**
Obstructions to Commerce, and how to remove them. By Lewis M. Haupt.

Commercial Geography—Ocean Route. **Kennelly.**
The Atlantic Ferry. Louisburg and Milford Haven. London: S. Straker & Sons, [1901]. Size 10 × 6, pp. 22. *Charts. Presented by the Author.*

On a project for making of Milford Haven and Louisburg the respective termini of the ocean route across the Atlantic, and by increasing the speeds by sea and land, to reduce the passage from London to New York to about four days seventeen hours.

Early Man. *Geolog. Mag.* 8 (1901): 337–344. **Howorth.**
The Earliest Traces of Man. By Sir Henry H. Howorth.

The writer does not accept as the work of man the supposed flint implements found in the plateau gravels of Southern England.

Historical. **Skeel.**
Travel in the First Century after Christ, with special reference to Asia Minor. By Caroline A. J. Skeel. Cambridge: the University Press, 1901. Size 7½ × 5, pp. x. and 160. *Map. Presented by the Cambridge University Press.*

An interesting sketch of the conditions of travel in the Roman Empire during the first century. The author draws from the writings of the Roman historians and

others illustrations of the classes of people who travelled in those days, and of the means of communication between the various parts of the Empire, briefly tracing the effects on the empire at large of the facilities which existed for intercommunication, and the reasons which led to a decay of the system.

Historical. **Winckler, Schurtz, and Niebuhr.**

Weltgeschichte. Dritter Band. Westasien und Afrika. Von Dr. Hugo Winckler, Dr. Heinrich Schurtz, und Karl Niebuhr. Leipzig und Wien: Bibliographisches Institut, 1901. Size $10\frac{1}{2} \times 7$, pp. xlv. and 736. *Maps and Illustrations.*

The wide scope of the subject here treated of in a single volume necessarily involves great compression, and gives the work largely the character of a summary of existing knowledge in which little room is offered for originality of view. The authors appear well acquainted, however, with the results of recent research, and such problems as that of the possible ancient operation of Malay influence, the origin of the negro race, and of the former gold-mining inhabitants of South-East Africa, are clearly stated. What is perhaps chiefly lacking is breadth of treatment of the fundamental problems affecting the areas dealt with, and this is no doubt in part attributable to the divided authorship. Thus no general account is given of the mutual relationships of the various peoples, and the broad outlines of their known or probable migrations in historic or prehistoric times, but each section is more or less an independent monograph. The whole of North Africa is left out of consideration, this having been dealt with in the fourth volume ('Mediterranean Peoples'), which had previously appeared.

Historical Geography. **Schwarzer.**

Die Kunde der Entdeckung Amerikas im deutsch-slavischen Osten. Von Dr. Otfried Schwarzer.—Festschrift des Geograph. Seminars der Universität Breslau zur Begrüssung des XIII. Deutschen Geographentages. Pp. 133–157. Breslau, 1901. Size $9\frac{1}{2} \times 6\frac{1}{2}$.

Traces the share taken by the literary centres of Germany and Poland in the dissemination of knowledge respecting the discovery of America.

Historical Geography. **Vignaud.**

La Lettre et la Carte de Toscanelli sur la route des Indes par l'Ouest adressées en 1474 au Portugais Fernam Martins et transmises plus tard a Christophe Colomb. Étude critique sur l'authenticité et la valeur de ces documents et sur les sources des idées cosmographiques de Colomb suivie des divers textes de la Lettre de 1474, traductions, annotations et fac-simile. Par Henry Vignaud. (Recueil de Voyages et de Documents pour servir a l'Histoire de la Géographie depuis le XIII[e] jusqu'à la fin du XVI[e] siècle. XVIII.) Paris: E. Leroux, 1901. Size $11 \times 7\frac{1}{2}$, pp. xxx. and 320.

This will be the subject of a review.

History of Geography. **Beazley.**

The Dawn of Modern Geography. Part II. A History of Exploration and Geographical Science from the close of the Ninth to the middle of the Thirteenth Century (c. A.D. 900–1260). By C. Raymond Beazley. With Reproductions of the principal Maps of the time. London: John Murray, 1901. Size 9×6, pp. xx. and 652. *Price* 18*s.*

This will be specially reviewed.

Man and Nature. *Die Natur* **50** (1901): 483–485. **Tamborini.**

Die Einwirkung des Menschen auf die Natur. Von Fr. Ferd. Tamborini.

BIOGRAPHY.

Biographical Dictionary. **Figueroa.**

Diccionario Biográfico de Estranjeros en Chile. Por Pedro Pablo Figueroa. Santiago de Chile 1900. Size $11 \times 7\frac{1}{2}$, pp. 262. *Portrait. Presented by the Author.*

Biographical notices of persons of foreign extraction who have settled in Chili and there attained to eminence. Of geographers and other scientists, we find the names of Dr. R. Philippi, Amado Pissis, Dr. Hans Steffen, F. A. Fonck, and Ignacio Domeyko. Spanish names decidedly predominate, natives of other South American States, and even temporary visitors, such as Dr. F. P. Moreno, being included.

Biographical Dictionary. **Lee**

Dictionary of National Biography. Edited by Sidney Lee. Supplement. 3

volumes. London: Smith, Elder & Co., 1901. Size 9½ × 6¼, pp. (vol. i.) lii. and 480; (vol. ii.) vi. and 452; (vol. iii.) vi. and 522. *Plate.*

This supplement contains a thousand articles, more than two hundred of which represent accidental omissions from the original work, the remainder being memoirs of persons who have died since the publication of the respective volumes in which their names would otherwise have appeared. Of the distinguished geographers included in the latter category, most have been the subject of obituary memoirs published from time to time in the *Proceedings* and *Journal.*

Cazemajou. *B.S.G. Marseille* **25** (1901): 113–135. **Léotard.**

Le Capitaine Cazemajou. Par M. Jacques Léotard. *With Portrait.*

The unfortunate expedition of Captain Cazemajou to the southern borders of the Sahara has been frequently alluded to in the *Journal.*

Hazelius. *Deutsche Rundschau G.* **23** (1901): 571–572. ——

Dr. Arthur Immanuel Hazelius. *With Portrait.*

This Swedish linguist and ethnologist lately died at the age of sixty-eight years.

Mendelssohn. **Kämmerling.**

Georg Benjamin Mendelssohn und seine Schilderung des Riesengebirges. Von Paul Kämmerling.—Festschrift des Geograph. Seminars der Universität Breslau zur Begrüssung des XIII. Deutschen Geographentages. Pp. 158–177. Breslau, 1901. Size 9½ × 6½.

The writer wishes to rescue from oblivion the work of a noted German geographer —cousin of the great composer—whose memoir on the Riesengebirge is worthy, he says, to be placed with those of Von Buch and Sydow.

Nordenskiöld. **Nathorst.**

Adolf Erik Nordenskiöld. Von Prof. Dr. A. G. Nathorst.—Geographischer Anzeiger herausgegeben von Justus Perthes in Gotha. September, 1901. Size 11 × 9, pp. 129–131. *Portrait. Presented by the Author.*

GENERAL.

Belgian Colonies. *B. Comité l'Afrique Française* **11** (1901): 336–338. ——

La charte coloniale de la Belgique.

Colonial Administration. **Bigelow.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 562–574.

Colonial Administration in different parts of the World. By Poultney Bigelow.

Education. *Verh. Siebenten Internat. G. Kongresses*, 1899, **2** (1901): 946–953. **Ebeling.**

Die Anfertigung von Reliefs in der Schule und für die Schule. Von Dr. Max Ebeling.

Education. *Verh. Siebenten Internat. G. Kongresses*, 1899, **2** (1901): 969–973. **Zimmerer.**

Projektionsbilder als Anschauungsmittel für Schulen. Von Prof. Dr. H. Zimmerer.

Education. *Vierteljahrshefte G. Unterricht.* **1** (1901): 1–8. **Höck.**

Die biologische Erdkunde im Schulunterrichte. Von Dr. F. Höck.

Education. **Partsch.**

Die Geographie an der Universität Breslau. Von Dr. J. Partsch.—Festschrift des Geograph. Seminars der Universität Breslau zur Begrüssung des XIII. Deutschen Geographentages. Pp. 1–37. Breslau, 1901. Size 9½ × 6½.

Education. *G. Teacher* **1** (1901): 4–10. **Rooper.**

On Methods of Teaching Geography. By T. G. Rooper.

Education—Excursions. *G. Teacher* **1** (1901): 32–36. **Reynolds.**

Class Excursions in Wales and England. By J. B. Reynolds.

Education—Maps. *G. Teacher* **1** (1901): 17–22. **Andrews.**

The Use of Maps in Geography Teaching. By A. W. Andrews.

Education—Methods. **Ratzel.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 931–940.

Die Lage im Mittelpunkt des geographischen Unterrichts. Von Prof. Dr. Friedrich Ratzel.

Education in Germany. *Petermanns M.* 47 (1901): 202–205. ———
Der geographische Unterricht an den deutschen Hochschulen im Wintersemester 1901–1902.

French Colonies. *Questions Dipl. et Colon.* 12 (1901): 615–628. **Dubois and Terrier.**
Un siècle d'expansion coloniale. Conclusion. Par Marcel Dubois et Auguste Terrier.

The final chapter of a history of French Colonial expansion lately published.

French Colonies. **Mourey and Brunel.**
L'Année Coloniale, publiée sous la direction de MM. Ch. Mourey et Louis Brunel. Deuxième Année (1900). Paris: Montgredien et Cie. Size 9 × 5½, pp. 442. *Maps and Illustrations. Presented by the Publishers.*

The first volume of this useful publication was noticed in the *Journal* for March last (vol. xvii. p. 327).

Geographical Congress. *B.S.G. Com. Bordeaux* 27 (1901): 286–288. ———
Vœux émis par le 22e Congrès des Sociétés françaises de géographie (Nancy, 1–5 août 1901).

Resolutions of international interest were: one recommending the adoption by all geographers of a series of conventional signs in cartography, and another urging the revision of the international Cable Convention of 1884.

Geographical Exhibition. ———
Katalog der Ausstellung des XIII. Deutschen Geographentages zu Breslau. Den Mitgliedern und Teilnehmern der Versammlung überreicht vom Ortsausschusse. Breslau, 1901. Size 9 × 6, pp. iv. and 52.

Geographical Progress. *Deutsche Rundschau G.* 23 (1901): 535–549. **Lenz and Jung.**
Fortschritte der geographischen Forschungen und Reisen im Jahre 1900. 3. Afrika. Von Oskar Lenz. 4. Australien und die Südsee. Von Dr. Emil Jung.

Geography. **Hartert.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 467–472.
Ueber Zweck und Methode zoogeographischer Studien. Von Ernst Hartert.

Geography. **Ratzel.**
Die Erde und das Leben. Eine vergleichende Erdkunde. Von Prof. Dr. Friedrich Ratzel. Erster Band. Leipzig und Wien: Bibliographisches Institut, 1901. Size 10½ × 7, pp. xiv. and 706. *Maps and Illustrations. Presented by the Publishers.*

This will be reviewed elsewhere in the *Journal.*

German Hydrographical Office. ———
Dreiundzwanzigster Jahresbericht über die Thätigkeit der Deutschen Seewarte für das Jahr 1900, erstattet von der Direktion. Beiheft II. zu den "Annalen der Hydrographie und Maritimen Meteorologie," 1900. Hamburg, 1901. Size 10½ × 7½, pp. iv. and 104.

Medical Geography. *Atti R.A. Lincei, Rendiconti* 10 (2) (1901): 123–131. **Grassi**
A proposito del paludismo senza malaria. Nota del B. Grassi.

Place-names—Orthography. ———
Second Report of the United States Board on Geographic Names. 1890–99. Second Edition. Washington, 1901. Size 9½ × 6, pp. 150. *Presented by the United States Government.*

Sailing Directions. ———
Sailing Notes for 1900. Published by the Chief Hydrographic Department of the Ministry of Marine. [In Russian.] St. Petersburg, 1901. Size 9½ × 6½, pp. 802 and 26.

Travel. **Haggard.**
A Winter Pilgrimage. Being an Account of Travels through Palestine, Italy, and the Island of Cyprus, accomplished in the year 1900. By H. Rider Haggard. London: Longmans & Co., 1901. Size 9 × 6, pp. 356. *Illustrations. Price 12s. 6d. net. Presented by the Publishers.*

Although hardly taking his readers off the beaten track, Mr. Haggard has always something of interest to tell of the countries visited, and his book will well repay perusal. The section on Cyprus is naturally the most important, and the author's views on the resources and prospects of the island deserve attention. Its great need

is said to be capital, without which its great natural wealth, agricultural and other, lies ungarnered.

Year-book. **Ricchieri.**

Piccolo Annuario Geografico e Statistico compilato dal Prof. Giuseppe Ricchieri. Supplemento al Testo-Atlante Scolastico di Geografia Moderna dei Prof. G. Roggero, G. Ricchieri, A. Ghisleri per l'anno 1900–1901. Bergamo: Instituto Italiano d'Arti Grafiche. Size 9 × 6, pp. 116. *Maps. Presented by the Compiler.*

A useful summary of recent geographical progress and statistics.

Year-book. **Trübner.**

Minerva. Jahrbuch der gelehrten Welt. Herausgegeben von Dr. K. Trübner. Elfter Jahrgang, 1901–1902. Strassburg: Karl J. Trübner, 1902 [1901]. Size 9½ × 4½, pp. xxviii. and 1242. *Portrait.*

Minor additions continue to be made to this useful work, bringing it still nearer than previously to absolute completeness. Thus the full staff of Cooper's Hill College is given for the first time, former issues having taken into account merely the Forestry Section. A sketch of the constitution of Birmingham University is also given.

Year-book. **Wagner.**

Geographisches Jahrbuch. XXIV. Band, 1901 . . . . herausgegeben von Hermann Wagner. Erste Hälfte. Gotha: Justus Perthes, 1901. Size 8½ × 5½, pp. 248.

This part deals with recent progress in cartographical methods, meteorology, oceanography, and ethnology.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Austria—Hungary. **Artaria.**

Eisenbahn- u. Postkarte von Oesterreich-Ungarn. Vierte Neubearbeitung. Scale 1: 1,500,000 or 23·6 stat. miles to an inch. Verlag von Artaria & Co., Wien, 1902. *Price* 2.20 *kronen. Presented by the Publishers.*

British Isles. **Hirschberg and Oestergaard.**

Map of the British Isles. Scale 1 : 865,340 or 13·5 stat. miles to an inch. Printed at the fine art works of Hirschberg and Oestergaard, Berlin. *Price* 2 *marks.*

This is a cheap and roughly produced map of the British Isles, with an inset in the lower left-hand corner showing the British Empire in red, and plans of London, Edinburgh, and Glasgow. The lettering is in English, and the map has been prepared partly with the idea of inducing the editors of English newspapers to publish it in this country; but it should hardly be necessary for them to use this when better maps by British publishers exist.

England and Wales. **Ordnance Survey.**

Ordnance Survey of England and Wales:—Revised sheets published by the Director-General of the Ordnance Survey, Southampton, from December 1 to 31, 1901.

1-inch:—

With hills in brown or black: 86, 107, 112, 143, 147, 156, 167, 194 (engraved), 1*s. each.*

Printed in colours: 9, (132, 148) combined, 157, 158, 159, 160, 161, 172, (177, 194) combined, 211, 1*s. each*; (129 (part of), 145) combined, (130, 146) combined, (193, 210) combined, (229, 246) combined, 1*s.* 6*d. each.*

6-inch—County Maps:—

Bedfordshire, 4 N.W., 17 N.W., S.W., 18 N.E., 21 N.W., N.E., 22 S.E., 23 N.W., 25 N.E., S.E., 26 N.W., N.E., 27 N.W., 28 N.E., 29 N.W., S.E., 30 S.W., 32 N.E., S.E., 34 N.W., S.W. **Cardiganshire,** 1 S.E. **Derbyshire,** 57A N.E., 58 N.W. **Merionethshire,** 33 N.E., S.W., 34 S.W., S.E., 35 S.E., 36 N.W., S.W., 41 N.W., S.W., 42 S.W., 43 N.W., 45 N.E., 46 N.W., N.E., S.W., S.E., 47 N.W., 48 S.E. **Monmouthshire,** 17 N.E., S.E., 23 N.W. **Montgomeryshire,** 7 S.E., 19 N.W. **Staffordshire,** 29 N.W., S.W., 30 N.W., S.W., 36 N.E., S.W., 37 S.W., 38 N.W., 39 N.W., N.E., 40 N.W., N.E. **Wiltshire,** 63 N.W., 66 N.E., S.W., 67 N.W., 71 N.E., 73 S.W., 76 N.W., 77 S.W., 78 N.W. 1*s. each.*

25-inch—County Maps:—

Cambridgeshire, V. 3, 7; VI. 10, 14, 15; X. 15; XI. 3, 12, 16; XIV. 3; XV. 7, 8, 11, 12, 15, 16; XX. 3, 6; XXIV. 11, 12, 15, 16; XLIV. 15. **Cardiganshire**, II. 4. 8. **Dorsetshire**, III. 16; VII. 8, 11; XXXIII. 13; XXXIV. 8; XXXV. 9, 13, 14, 15; XLIII. 4, 8, 9; L. 5, 10, 15, 16; LI. 5, 9, 13; LVI. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; LVII. 1, 2, 5, 6; LIX. 2, 3. **Gloucestershire**, I. 12, 14; II. 13, 14, 15; III. 3, 4, 6, 7, 14; IV. 5, 6, 7; VI. 6, 8; XXII. 6; XXIX. 3. **Huntingdonshire**, XI. 6; XV. 6, 10, 11, 14, 15, 16. **Monmouthshire**, XV. 9; XXI. 13; XXVI. 5; XXX. 15; XXXI. 9; XXXIV. 1; XXXV. 1, 3. **Montgomeryshire**, VI. 15; XI. 5, 9, 13, 14, 15, 16; XV. 4, 8, 12; XVI. 2; XXVI. 8; XXVII. 9, 11, 13; XXXII. 4, 8; XXXIII. 2, 12; XXXIV. 1, 9. **Shropshire**, IX. 7; XV. 2, 3, 4, 6, 10, 11, 14, 15; XVIII. 11, 15, 16; XIX. 9, 13; XXI. 11, 12, 14, 15; XXII. 1, 2, 3, 5, 7, 10, 11, 12, 13, 14, 15, 16; XXVI. 5, 9, 15, 16; XXVIII. 3, 4, 7, 12; XXIX. 1, 2, 3, 5, 6, 10, 12; XXX. 3. **Staffordshire**, XLIV. 3, 7; LIII. 1, 5, 9, 10, 14, 15; LIV. 13. **Warwickshire and Do. (Det.)**, I. 13; XLIV. 13, 14*, 15*, 16* (*Areas of Atherstone on Stour Parish only shown); L. 6, 7, 11. **Worcestershire and Do. (Det. No. 3)**, XXXVII. 12, 15, 16; XLIII. 14; XLIV. 7, 11; XLV. 1. 3*s. each.*

6-inch scale:—

Tunbridge Wells, printed in colours showing borough and ward boundaries, 2*s.* (*E. Stanford, London Agent.*)

Germany. **Halbfass.**

Karte von Hinterpommern zur Uebersicht derjenigen in den Jahren 1899 und 1900. Scale 1 : 500,000 or 7·8 stat. miles to an inch.—125 Tiefenkarten Pommerscher Seen auf 5 Blättern hauptsächlich auf Grund der Mefstischblätter. Scales 1 : 50,000, 1 : 25,000, 1 : 12,500, 1 : 6,250. Tafels 1–5. Profile Pommerscher Seen. Scales 1 : 12,500, 1 : 6250. Tafel 6. Von Dr. W. Halbfass. *Petermanns Geographische Mettteilungen*, Erganzungsheft No. 136. Gotha: Justus Perthes, 1901. *Presented by the Publisher.*

Germany. **Konigl. Preuss. Landes-Aufnahme.**

Karte des Deutschen Reiches. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Herausgegeben von der Kartogr. Abtheilung der Konigl. Preuss. Landes-Aufnahme, 1901. Sheets: 173, Aurich; 176, Bremervöde; 177, Buxtehude; 207, Ottersberg; 260, Nienburg. *Price* 1.50 *marks each sheet.*

Italy. **Gerland.**

Verteilung der Erdbebenthätigkeit in Italien nach M. Baratta. Scale 1 : 5,000,000 or 79 stat. miles to an inch. Von G. Gerland *Petermanns Geographische Mitteilungen*, Jahrgang 1901. Tafel 20. Gotha: Justus Perthes. *Presented by the Publisher.*

Liverpool Bay. **Belam and Ashton.**

Chart of Liverpool Bay. Scale 1000 yards to an inch. Surveyed by Henry Belam, Commander R.N., of the Mersey Docks and Harbour Board, and H. G. G. Ashton, Assistant Marine Surveyor, 1901. *Presented by H. G. G. Ashton, Esq.*

A comparison of this chart with that based upon the surveys of Commander G. H. Hills, R.N., a former Marine Surveyor to the Mersey Dock and Harbour Board, of 1883. is interesting as showing the changes that have taken place in the sandbanks and depths of water during the interval. The chart is most complete in soundings, tidal information, position of lights, and other facts that will be invaluable for the safe navigation of the Mersey entrance. It has, however, evidently been reduced from a larger one by photography, with the very common result that the figures and lettering are so small as to be almost illegible in some places, which is certainly to be regretted.

Mediterranean Sea. **Henkel.**

Grenze der Sichtbarkeit des Landes auf dem Mittelmeer. Scale 1 : 15,000,000 or 237 stat. miles to an inch.—Sichtweite einiger bemerkenswerter Gipfel der Griechischen Küsten. Scale 1 : 3,700,000 or 58 stat. miles to an inch. Von Dr. L. Henkel. Gotha: Justus Perthes. *Presented by the Publisher.*

Shows, by means of blue tinting and red lines, the distance from which land is visible in different parts of the Mediterranean sea. The map accompanies an interesting article by Dr. L. Henkel in *Petermanns Geographische Mitteilungen* for December, 1901.

ASIA.

Asia Minor. **Kiepert.**

Karte von Kleinasien. Scale 1 : 400,000 or 6·3 stat. miles to an inch. Von Dr. Richard Kiepert. Sheet: B. IV., Jozgad. Berlin: D. Reimer (Ernst Vohsen), 1902. *Price 6 marks each sheet.*

Although at the present time no complete trigonometrical survey of Asia Minor exists, yet a great deal of survey work of one kind and another has been done in the country, especially during recent years. This varies very much in its character and value, ranging from the comparatively accurate triangulation work of certain districts by English and German officers, to the rough prismatic compass route maps of travellers and archæologists who have had no special training as surveyors. From the date of the appearance of the late Dr. H. Kiepert's well-known map of Asia Minor, compiled from his own surveys and all then existing material, in 1844, to the present time much has been done to extend our knowledge of the country. In 1884 Dr. H. Kiepert published his map entitled "Nouvelle Carte Générale des Provinces Asiatiques de l'Empire Ottoman," on the scale of 1 : 1,500,000. This included a greater area than his earlier map, and was based upon one in M.S., drawn by the author on the scale of 1 : 500,000. Eight years later, in 1892, the publication of his excellent map of Western Asia Minor in fifteen sheets, on the scale of 1 : 250,000, was completed. Since Dr. H. Kiepert's death, in 1899, his son, Dr. R. Kiepert, has been engaged upon the preparation of the new map of the country of which the first sheet has just been published, and which is to include the whole of Asia Minor and portions of Armenia and Northern Syria. This map is on the scale of 1 : 400,000, and no pains will be spared to make it as complete as possible. The vast amount of material accumulated by the late Dr. H. Kiepert, including his own original large-scale drawings, have been utilized, in addition to which advantage has been taken of the latest survey work. In addition to the sheet just published, seven others are in an advanced state, and it is hoped that the whole map, which will consist of twenty-four sheets, will be finished in three or four years. Special attention has been given to the nomenclature, which has been placed under the superintendence of Prof. Dr. Martin Hartmann. The map is printed in three colours, hill-work brown, lakes blue, and lettering, rivers, and roads are black.

Asiatic Russia. **Russian Government**

Chart of the Southern Portion of Lake Baikal. Scale 1 : 252,000 or 3·9 stat. miles to an inch. Compiled from the Hydrographical Surveys of the Baikal Lake Expedition in 1897–99. (Russian character.) *Presented by Lieut.-Colonel J. de Schokalsky.*

Lake Baikal from its southern end to lat. 52° 40′ N. only is shown on this portion of the chart, but before long it is hoped that the northern half will be completed. However, this is the important section of the lake at the present time, in connection with the Trans-Siberian railway. The chart shows the coast-line and fourteen lines of soundings across the lake; many other soundings are given near the shore.

China. **Vogelsang.**

Wege-Aufnahmen im nördlichen Teil der Provinz Chi-li. Scale 1 : 500,000 or 7·8 stat. miles to an inch. Von Dr. Karl Vogelsang. *Petermanns Geographische Mitteilungen.* Jahrgang 1901. Tafel 19. Gotha: Justus Perthes. *Presented by the Publisher.*

Hong Kong. **Public Works Department, Hong Kong.**

Plan of Victoria City, Hong Kong. Scale 60 feet to an inch. Public Works Department, Hong Kong. 1901. New edition. 29 sheets. *Presented by H.M. Secretary of State for the Colonies.*

A new edition of a plan of Victoria, Hong Kong, in twenty-nine sheets, showing buildings, roads, etc., up to date.

Kaulun. **Public Works Department, Hong Kong.**

Plan of Kaulun. Scale 205 feet to an inch. Public Works Department, Hong Kong, 1901. 5 sheets. *Presented by H.M. Secretary of State for the Colonies.*

A large-scale survey map, in black and white, of the new British territory on the mainland of China, opposite Hong Kong.

AFRICA.

Africa. **Cora.**

Africa a Base Fisica. Scale 1 : 8,000,000 or 126 stat. miles to an inch. Prof. Guido Cora. Torino: G. B. Paravia e Comp., 1901. 4 sheets. *Presented by the Publishers.*

This is a coloured wall-map of Africa evidently intended for educational purposes.

It is in four sheets, and when these are joined as one, the complete map measures about 4 feet square. The relief is shown by a combination of hachuring and colour-tinting. All land from 0 to 200 metres in altitude is shown by a tint of light green, 200 to 500 white, 500 to 2000 light brown, and above 2000 by a darker shade of brown. Depressions below sea-level are shown by a dark-green, and a special symbol is employed to indicate the deserts. There are also many figures on the map indicating the altitudes of certain points. Four different shades of blue are employed to indicate the depths of the ocean; but the lakes are all shown by one shade of blue, the darkest employed, which would lead to the erroneous idea that they are all more than 2000 metres in depth. Political divisions are shown by a thin red dotted line. The general effect cannot be considered altogether satisfactory, and the map is certainly not so clear as it ought to be, which is in great measure due to the fact that too many names are given for a map of this character. In addition to the principal map, two others are given on smaller scales, as insets, one being an ethnographical map of Africa, and the other a political map, upon which, however, the Transvaal and Orange River colony are shown as independent states. There is also a vertical section showing the elevations of the continent along the line of the equator.

Congo Free State. **Wauters.**

Le Lomami Inférieur. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Par A. J. Wauters. *Supplément au Mouvement Géographique* du 21 Juillet 1901.

A supplementary sheet to Wauters' map of the Congo Free State, showing the Lomami river and upper Congo in the neighbourhood of Stanley falls.

West Africa. **Calisti.**

Région Kati-Bamako. Scale 1: 20,000 or 528 yards to an inch. Par le Lieut. Calisti. Paris: Henry Barrère, 1901. 4 sheets.

A large-scale topographical survey of the district on the north bank of the Niger, in the neighbourhood of Bamako, the terminus of the proposed railway to connect the Senegal with the Niger. The area embraced is about 200 square miles. The relief is shown by brown contour lines at intervals of 5 metres; water is coloured blue, and roads and tracks red. The survey was made at the time when the water in the Niger was very low.

AMERICA.

Brazil. **Stradelli.**

Mappa Geographico do Estado do Amazonas. Scale 1 : 2,222,000 or 35 stat. miles to an inch. Orgenizado por Ermanno Stradelli de accordo com suas notas e explorações e bascado nos melhores mappas 1901. Piacenza: V. Porta. *Presented by the Author.*

In the compilation of this map the author has made use of the best available material, of which he gives a list. Altogether he has consulted thirty-three different authorities, and it is evident that he has spared no pains to make his map as complete as possible. There are, however, many districts included within this region that are still unexplored. Considerable information is given by means of conventional signs concerning the rapids and falls of rivers, mission stations, etc., and places which have been fixed by astronomical observations are clearly distinguished, but these are very few in number.

Cuba. **Rand, McNally & Co.**

Indexed Pocket Map of Cuba. Scale 1: 2,407,480 or 38 stat. miles to an inch. Chicago and New York: Rand, McNally & Co., 1901.

French Guiana. **Guffroy.**

Carte de la Guyane Française. Scale 1 : 500,000 or 7·8 stat. miles to an inch. Dressée par Maurice Guffroy. Paris: Erhard Frères, 1901.

This new map of French Guiana will be decidedly welcome, especially as it is on a fairly large scale. But the author does not appear to have taken full advantage of all existing material. For instance, Dr. Crevaux's surveys would have furnished him with a good deal more information than he shows along the course of the Oyapock. No routes are given, and there is nothing on the map to show how much of it is taken from the work of other travellers, and how much from personal survey. It is printed in colours, and contains notes upon the character of the soil and rocks. A glance at the map will show that a great deal of the country still remains unexplored.

South America. **Cora.**

America Sud a Base Fisica. Scale 1 : 8,000,000 or 126 stat. miles to an inch. Prof. Guido Cora. Torino: G. B. Paravia e Comp., 1901. 4 sheets. *Presented by the Publishers.*

A wall-map of South America, similar in character to that of Africa noticed above, and the remarks upon that map apply, in general, to the present, except that this is somewhat clearer, not being so overcrowded with names. There are two inset maps, one ethnographical and the other political. There is also a vertical section across the continent along the parallel of 19° S. lat.

United States. **Rand, McNally & Co.**

Indexed Pocket Maps of Florida. Scale 1 : 1,203,840 or 19 stat. miles to an inch.—Connecticut. Scale 1 : 443,520 or 7 stat. miles to an inch. Rand, McNally & Co., Chicago & New York, 1901. Florida and Connecticut. *Price $25 each. Presented by the Publishers.*

These are new editions with corrections and additions to bring them up to date. They are very rough productions, but useful for general reference.

GENERAL.

French Colonies. **Pelet.**

Atlas des Colonies Françaises. Dressé par ordre du Ministère des Colonies par Paul Pelet. Paris: Armand Colin & Cie. Livraison 8. *Price 3 francs.*

The sheets contained in this part are as follows: Indo-Chine Française, in two sheets. 1 : 2,500,000—Afrique Occidentale. II. Guinée française et Côte d'Ivoire, 1 : 3,000,000. Although only just published, the first of these maps is dated June, 1900, and the second April, 1900. This long interval between the drawing and publication is doubtless in great measure owing to the process of engraving, but it is greatly to be regretted, as in many instances the maps do not contain the latest information available at the date of their publication. This is so in the case of the map of Indo-China here given, upon which the boundary between Burma and China is wrongly shown, although the survey of a great portion of the line was published about eighteen months ago, by the Indian Survey Department. The maps, like the others belonging to this atlas, are beautifully executed, and, in addition to the geographical features, show travellers' routes, with names and dates, in red. The text to accompany the map of Indo-China is also given with this part.

World. **Scobel.**

Neuer Volks- und Familien-Atlas in einhundert Kartenseiten. Herausgegeben von A. Scobel. Bielefeld und Leipzig: Velhagen & Klasing, 1901.

This atlas is composed of fifty-four maps, most of which occupy two pages. They are taken from the well-known Andree's Hand-Atlas, published by the same firm. There are three general maps, twenty-nine of Europe, five of Asia, six of Africa, five of America, four of Australasia and the Pacific islands, and two of the Polar Regions. Many of these contain insets and special diagrams and plans. It is essentially a German atlas, and fourteen maps are devoted to that country, whilst to the British Isles only one small-scale general map is given. The maps are printed in colours, but in many of them the physical features are but poorly represented. It is noticeable that the Transvaal and Orange River Colony are still shown as independent States, and there are other points that needed greater attention. No index is given. However, it is certainly a very cheap atlas, and many of the maps are good, and contain a great deal of information—too much, in fact, in some cases, where they are decidedly overcrowded with names.

World. **Spitaler.**

Linien gleichen Unterschiedes (Isodiaphoren) des wahren Luftdrucks in Januar und Juli. Von R. Spitaler. *Petermanns Geographische Mitteilungen*, Ergänzungsheft No. 137. Gotha: Justus Perthes, 1901. *Presented by the Publisher.*

World. **Stieler.**

Neue neunte Lieferungs-Ausgabe von Stieler's Hand-Atlas, 100 Karten in Kupferstich. 2 Lieferung. Gotha: Justus Perthes, 1901. *Price 60 pf.*

The two maps contained in this part are No. 57, West-Sibirien 1 : 7,500,000, and No. 92, Mexico, 1 : 7,500,000. Both are new maps, and have been drawn by H. Habenicht. The map of Western Siberia is especially well executed.

CHARTS.

North Atlantic Ocean and Mediterranean Sea. **Meteorological Office.**
Pilot Chart of the North Atlantic Ocean and Mediterranean Sea for January 1902. Meteorological Office, London. *Price 6d. Presented by the Meteorological Office.*

United States Charts. **United States Hydrographic Office.**
Pilot Charts of the North Atlantic Ocean for December, 1901, and North Pacific Ocean for January, 1902. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Persia. **Sykes.**
One hundred and six photographs of Persia, by Major P. Molesworth Sykes and others. *Presented by Major P. Molesworth Sykes.*

During Major Sykes' lengthy sojourn in Persia, and his extensive travels, he has had exceptional opportunities of obtaining most useful and interesting information concerning the country. Not only has he added considerably to our geographical knowledge by his surveys, but he has presented to the Society a most excellent series of photographs, most of which were taken by himself. Many of them will be specially interesting to the archæologist, but others illustrate the physical features of the country, the people, their dwellings, cities, shrines. and mode of life. The following is a list of the subjects:—

(1) Preparing carpets in Sultanabad; (2) Bushire; (3) Telegraph station, Reshire; (4) Mosque at Kum; (5, 6, 7) Maskat; (8) Near Resht; (9) Tea house near Kerman; (10) Rolling large Namad (felt), Isfapan; (11) Galag, Makran; (12) Bakhtiari girls; (13) A survey party; (14) Panjgur; (15) Guard of the British Consulate, Kerman; (16) The Sagoch range; (17) Brahui camel-men; (18) Arab girl; (19) Tobacco merchants; (20, 21) Jalk Oasis; (22) Shrine near Kerman; (23) Nomad children; (24) Kazerun; (25, 26) The shrine, Mahun; (27) Courtyard of Mahun shrine; (28) Garden, Mahun; (29) Persian woman; (30) Persian women in outdoor dress; (31) Achemenian tomb, Persepolis; (32) Ruins of Persepolis: Hall of Xerxes; (33) Xerxes porch, Persepolis; (34) Tomb of Hula Ku Khan, Maragha; (35) Tomb of mother of Hula Ku Khan, Maragha; (36) Tomb of vizier of Hulu Ku Khan, outside Maragha; (37) The god Hormuzd, Shapur; (38) Sheikhi sect, Kerman; (39, 40) Atabeg's stone, Kerman; (41) Consulate garden, Kerman; (42) Kerman; (43, 44) Parsis of Kerman; (45) Kerman garden; (46) Kerman gypsies; (47) Kerman merchant; (48) Ice-pits, Kerman; (49) Kerman forts; (50) Jabalia, Kerman; (51) Masjid-i-Malik, Kerman; (52) Masjid-i-Jama, Kerman; (53) Kala-i-Dukhtes, Kerman; (54) Banpur fort; (55) Persian pony; (56) Modern Isfahan vases; (57) The Meidan-i-Shah, Isfahan; (58 59) Basra; (60, 61) Basra creek; (62) Basra palm garden; (63) Parsi of Yezd; (64) Masjid-i-Jama, Yezd; (65) Gateway of Masjid-i-Jama, Yezd; (66, 67) Tomb of Keiani Malik, Jalk; (68) Parsi woman; (69) New Dakme, or place of exposure for the dead, Kerman; (70) Stage in the Lut; (71) Kala-i-Dukter, 8 miles north of Kerman; (72) Camp at Fahraj: (73) The Fanoch Pass; (74) Bagh-i-Takt, Shiraz; (75) Kalagan valley: (76) Perso-Baluch Commission: (77) Kurd girls; (78) Garden near Kerman; (79) H. H. The Farman: (80) Street in Tehran: (81) One of the Shah's gardens, Tehran; (82) Gateway, Tehran: (83) Tehran; (84) Kuh-i-Taftan: (85) Gurkhain copper mine, Abbasabad, Khorasan: (86) Fort in British Baluchistan; (87) Baluchis of Soran: (88) Valley of Chehel Tau or Tuftan range; (89) Carving near river of Jegatu: (90) Group of Baluchis; (91) Baluchis of Sib: (92) Gypsies of Baluchistan; (93) Sheikh of Ahwaz; (94) Keianian Malik tomb, with British and Persian Commissioners; (95) Mesjid-i-Shah; (96) Takht-i-Zendan, Kurdistan: (97) Aptar, east of Fahraj: (98) Hadrasé-i-Isfahan: (99) The Sufid road; (100, 101) Meshed; (102) Meshed shrine; (103) Yezd; (104) Kuhak, where Frontier Commission met; (105) Gumbuz-i-Subs, Kerman; (106) Khan of Kelat, and court.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.


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FROM SHANGHAI TO BHAMO.*

By R. LOGAN JACK, LL.D., F.G.S.

OUR party was employed by an English capitalist who had obtained mining concessions in the province of Sechuan, and consisted, besides the writer, of Messrs. J. Fossbrook Morris and R. Lockhart Jack, with an interpreter and the usual retinue of cook and servants.

We left Shanghai on January 4, 1900, by the Poi-yang, one of Butterfield and Swire's magnificent river steamers, which reached Hankau (600 miles) on January 7. A delay of eight days occurred before we could get a passage by the Sha-si, a smaller steamer of the same company, to I-chang (400 miles), which we reached on January 20. Here we hired a houseboat, which was dragged up the river by trackers to Chung-king (392 miles), the voyage occupying the time from January 23 to February 22. The Yang-tse, as far as Chung-king, has been so frequently described by officials, explorers, scientists, traders, and tourists, and the river has been so well charted by Father Chevalier, S.J., that this portion of the journey may be passed over in silence.

On March 5 we left Chung-king, our means of locomotion being no longer boats, but horses and sedan chairs, with a numerous following of coolies carrying our loads, and an escort of soldiers, which was changed at every Hsien, or county town, the returning escort always taking back a receipt for us, stamped and signed by the magistrate to whom they delivered us.

The journey from Chung-king to Cheng-tu, the capital of Sechuan (299 miles), took thirteen days. It has often been described by previous

* Read at the Royal Geographical Society, January 13, 1902. Map, p. 416.

travellers, but I may mention the extensive coal-deposits of Lai-feng-yi and Lung-chang Hsien, and the brine-wells of Nei-kiang Hsien, and the endless succession of anticlines and synclines of sandstone and limestone. One brine-well was 675 feet deep, the bamboo bucket being raised from the bore by a bamboo ribbon wound round a whim by a buffalo. Ploughing, harrowing, and hoeing were going on busily, the wooden ploughs being drawn by water-buffaloes. Travelling buffaloes were always accommodated with straw sandals. At Lung-chang we met M. Paul Duclos, of the Mission Lyonnaise, who was on his way to Chung-king. Captain Watts-Jones, who four months later was barbarously murdered at Kwei-hua-cheng, gave me, at Cheng-tu, a tracing of his plane-table survey, from which, as it was certainly a more careful one than any previous survey, it may be said with confidence that Lung-chang is about 18 miles south-west of the position previously assigned to it. At Nan-ching-yih we saw the first of the gigantic bamboo under-shot water-wheels used for irrigation.

Cheng-tu is a city of about three-quarters of a million inhabitants, and an important centre of silk and other industries, which are for the most part carried on in the streets. Here we were well received by the members of the Government Mining Department and were lodged in the Commissioner's yamen, which had been furnished in semi-European fashion for our use. I had an audience of the Viceroy. Surrounded by a retinue of civil and military dignitaries, he received me with great cordiality, and expressed freely his desire that British capital should come to the assistance of Sechuanese industry. He arranged that, for our protection and prestige, we should be accompanied by a Wai-yuan, or official of magisterial rank, red-silk umbrella and all, as well as by a military escort; and that a proclamation commanding respect and assistance should always precede us on our travels throughout the province. Besides experiencing many kindnesses from the missionaries, we met at Cheng-tu an interesting group of native officials, among others the Tartar General, the Provincial Treasurer, the Secretary for Foreign and General Chee, who was "out" with Chinese Gordon.

Cheng-tu Plain is probably the most intensely cultivated portion of the Earth's surface. It is about 70 by 40 miles, and supports a population of four millions. Two facts may be mentioned as showing its quality. It often grows seven crops a year, and it pays to borrow money at 30 per cent. to cultivate it. It was fair in beans and still fairer in rape, but I shall never forget its marvellous beauty when it was covered with poppies of every hue from white to purple. The secret of its fertility is irrigation. Many large rivers enter it, and are immediately seized upon and diverted into channels, which are led over the fields in every direction, turning mills by means of over- or under-shot bamboo or wooden wheels and turbines. The engineer, Li Ping, who devised the scheme of irrigation two thousand years ago, has, very

properly, been assigned a place in the Chinese pantheon, a magnificent temple having been erected in his honour at Kwan Hsien.

Our first excursion from Cheng-tu was to the copper-mines of Tung-ling-tse and back, a journey covering 124 miles, which took fourteen days (April 3 to 16). We were accompanied and introduced by Tong Sing Kow, Managing Director of the Government Mining Department, and a Wai-yuan, Hung, with a guard of soldiers. After passing through the walled city of Pen Hsien, we entered, at Kwang Kau, the valley of the Chian-kiang, a river about the size of the Tay at Perth. Messrs. Jack and Morris mapped its course nearly to its head, as

GEOLOGICAL PARTY'S HOUSEBOAT IN THE MIDDLE RAPID, CHIN-TAN (HUPEH).
(*R. Lockhart Jack, photo.*)

well as the course of a tributary, the Pai-sui Ho, and another stream. This has not been done before, although, no doubt, the valley has been visited by missionaries. The valley afforded some lovely scenery, and formed a strong contrast to Australia, which we had not long left, as there was abundant running water everywhere, and we were scarcely ever out of sight of falls and "staub-bachs" 700 or 800 feet in height. We camped in tents at the monastery of Tung-ling-tse, near the head of the valley, as the house accommodation was insufficient for our large party. We visited other copper-mines on the Pai-sui Ho, chiefly remarkable for the daring though bad engineering of the roads leading to them, as they ascend thousands of feet without

any attempt at grading, and cross ravines and climb precipices by bridges made of a couple of logs or ladders made of notched saplings. I reached places where the snow of the previous winter was still lying, and Messrs. Morris and Jack made an attempt to reach a group of mines on the Chun-chan Shan further north, but were baffled, at an estimated elevation of 12,000 feet, by the depth of the snow. Of course we did most of this work on foot, but our Wai-yuan, Hung, did his part on a saddle on a coolie's back. No Chinese official would do anything so undignified as to walk. Even a coolie, when promoted to be a "boy," soon discovers that he "cannot" walk.

This trip was chiefly remarkable for the enthusiasm with which local officials entered into the spirit of the Viceroy's orders for ensuring our safety. The guards varied in numbers and armament. On approaching Kwan Hsien, for instance, the Peng Hsien guard was relieved by the new one, consisting of 6 black flags, 6 red flags, 2 trumpets, 4 Lochaber axes, 7 tridents, 2 swords, and 25 rifles.

Our next trip from Cheng-tu was a "round" one, to Lung-an and Sung-pan and back *viâ* Kwan Hsien. It took us from April 25 to May 31, the distance being 607 miles. We left the main Pekin Road, which has been travelled by Gill, Mrs. Bishop, and many others, at Se-te Chau, and followed to the north a road leading to An Hsien, which, as it was within sight of the range to the west, gave us an opportunity of laying down the edge of the Cheng-tu Plain with more accuracy than it has hitherto been done. Beyond Sin-tu Hsien, we met a long caravan of Tibetans on mules, and a prisoner, dressed in red, carried in a cage with an official seal across the front of it. Shih-feng Hsien is a centre of tobacco-cultivation, and M'yen-chu Hsien is famous for its paper manufacture. Near the latter, coke comes down in barrows from the hills to the west. An Hsien is a very minute walled city, with an elaborate concrete training wall for the prevention of floods. We were lodged in the clubhouse of the Cantonese guild, consisting of a number of elegant and comfortable buildings among grounds tastefully laid out with rockeries, shrubberies, temples, and ornamental water. Here we enjoyed the agreeable society of some ladies and gentlemen of the Church Mission, and had a call from the Hsien, or magistrate, a brisk and energetic official, who had just been appointed to the government of a district with a bad reputation for robbery. He had begun after the customary method of new brooms, having hanged two robbers and arranged for the execution, next day, of a third, before making his call on us. There are some alluvial gold workings in the neighbourhood of the city, and coal comes from the north.

After crossing some passes to the north, we struck, at Chu-shan, the right bank of the Che-chuen river, which we followed to the north-west to Shih-chuen Hsien. Here, besides some pretty bamboo suspension bridges, we first saw the so-called "Himalayan" bridge, of a single

bamboo rope. We watched a woman attach a load of wood to the rope, seat herself on it, and, after sliding to the bottom of the sag, pull herself and the load, hand-over-hand, to the opposite bank.

After some excursions in the neighbourhood of Shih-chuen, looking at alluvial gold workings in the river (which rises in the snow-capped dividing range between the Min and the Fu), we returned to Chu-shan. The river is one continuous rapid all the way. Striking eastward from Chu-shan, the road ascends 2149 feet (to 5350 feet above

BRINE WELL IN DRY BED OF YANGTSE AT KWEI-FU, SECHUAN.
(*R. Lockhart Jack, photo.*)

the sea) in a mile and a half. Strings of coolies toiled up the steep, laden with wool from Tibet for shipment at Tung-kau, which is approached by a steep descent after passing some coal-mines. The river falls into the Fu a few miles below Tung-kau, where there is a very fine bamboo suspension bridge and a picturesque harbour.

In about 15 miles more to the east, we were in the valley of the Fu, which we followed up to its head. As this part of the journey has already been described by Gill, I need not dwell on it. The river

is navigable, in a way, at least for rafts, as far as Hsiang-ngai pa. The Fu, or Prefect, of Lung-an now resides in the more accessible and agreeable little city of Kiang-yu Hsien, a subordinate official remaining in charge of Lung-an. Consequently, as the name follows the official, Kiang-yu is now known locally as Lung-an, while Lung-an has been re-christened Ping-wu. The circumstance is noted as an instance of the difficulty of identifying Chinese places by their names. There are gold terrace and "beach" workings from Ping-i-pu upwards. A pontoon bridge was noted at Chiu Chau.

Lung-an is a small but busy town, with a remarkable old temple dedicated, I was informed, to the "President of Purgatory." The name may have resulted indirectly from the presence in the town of a Catholic mission. We called at the mission, but found that the father was from home.

From Lung-an to the snow-clad pass of the Hsueh Shan, the valley of the Fu is a gem of beauty, to which artists will surely make pilgrimages when they have exhausted Switzerland, Italy, and Norway. Seven miles above Lung-an, a dilapidated fortified gateway spans the road, the first of the aforetime defences of the Chinese against the inroads of the savages from the west. Hsiao-ho-ying is a fort supposed to have a garrison of a thousand, but actually housing thirty, soldiers. Its defensive wall (which, by the way, is commanded by the hills on the east and west) is pretty perfect, though overgrown with weeds. One corner of it, as well as most of the houses, was carried away by a flood a few years ago, but has been repaired. At Sui-ching-pu we saw some primitive quartz-crushing mills driven by water-power.

The pass of Hsueh Shan (13,360 feet) proved difficult, as not only was there snow over a foot deep, but a blinding snowstorm drove in our faces, and most of the party had some experience of the "mountain sickness." The Chinese suffered more than we did, which may be attributed, I think, partly to opium and partly to "funk." The Interpreter became black in the face, although he and the Wai-yuan rode in chairs all the way, while the others walked. Two of the coolies lay down exhausted in the snow, and had to be carried down. One of the soldiers died of the effects a few days after, while being carried in a chair to the nearest hospital. On the descent to Sung-pan we made our first acquaintance with the Mantzü people, and passed some temples adorned with poles from which prayer-flags fluttered, a sign that we were among people who professed the religion of the llamas.

At Sung-pan we heard that Captain Watts-Jones and Mr. Birch, whom we had seen for the last time in Cheng-tu, had passed through on their way north the day before (May 19). Birch was drowned in the Hoang Ho near Lan Chau on June 24, and Watts-Jones was barbarously murdered at Kwei-hua Cheng a few weeks later by the Deputy Prefect.

We had a heated dispute with the "Ting," or Sub-Prefect, of Sung-pan, who was at first inclined to treat us with marked incivility; but we eventually became good friends, and he and the military bigwigs vied with one another in their attentions.

The exceedingly interesting journey down the Min has been so well described by Gill and others, that there is little to add. Sung-pan is the furthest outpost of Chinese civilization—the last stronghold or edge of the wedge driven into the heart of Mantzü barbarism. I

CAST-IRON URN IN TSING YANG KUNG TEMPLE, CHENGTU.
(*R. Lockhart Jack, photo.*)

must admit that the Mantzü appeared to us even more pleasing in features and manners than the Chinese; but they were shy, and, as we could only converse with them through the Chinese (who look upon them as beneath their notice), we had little communication with them. The Chinese have opened the road through their country by erecting miniature "kwans," or fortified garrison towns, at short intervals. The dwellings of the Mantzü, built for protection, are exceedingly picturesque.

In the walled Chinese city of Mao-chau, the doors of our inn were scribbled over, while we slept, with anti-foreign inscriptions, which nothing would induce Chu Ling Chung, our Interpreter, to translate, although he admitted that they were "very bad words."

We emerged on the Cheng-tu Plain at Kwan Hsien on May 30, and reached Cheng-tu the following day.

On our return to Cheng-tu, Mr. Herbert Way, who represented an English company, was added to the party, with his interpreter, Nee Sui Ching, and servants. We had a new Wai-yuan, named Chi Hung Chi, a man full of energy and resource. We left Cheng-tu, to visit the mines of the Ning-yuan and Ya-chau prefectures, on June 19. The journey from Cheng-tu to Ning-yuan having been described by Richthofen, Baber, Hosie, and others, it is only necessary to mention a few incidents of our trip.

At Kiung-chau we found that the bridge mentioned by Gill had been washed away by a flood, and was being replaced by one of cyclopean masonry.

At Ya-chau we found that the telegraph line was down and would be useless to us, as telegrams handed in were simply forwarded by messengers. This was a disappointment, as it placed us 111 miles—the distance to Cheng-tu—further from a telegraph station than we had anticipated.

At Kwang-ni-pu we visited iron-smelting works and foundries where large cooking-pots are made, and were informed that skilled experts are highly paid—as they deserve to be—for tasting and reporting on the liquid manures which form no small proportion of the traffic on the roads.

We had heard in Cheng-tu of a famine in the district of which Yueh-Sui is the centre, and had provided an extra supply of rice for the use of our coolies; but it proved hardly necessary, as recent rain appeared to have given a new aspect to the outlook. Indeed, we found the north gate of the city closed, and the magistrate offering sacrifices to stop the rain. The Hsien told us that the day before our arrival Lolo aborigines had made a raid within 2 miles of the city, and killed two Chinese and carried off half a dozen head of cattle. Such events are said to be quite frequent, and Chinese are often carried away into captivity. The Lolos do not wear sandals, and are said to despise the Chinese for being "soft" enough to need them, and for this reason they burn the soles of the feet of their prisoners. The Chinese have opened, and maintain, by means of small garrisons and blockhouses, a road connecting Cheng-tu with Tali Fu through the heart of the Lolo country, but do not attempt a general subjugation. As a rule the Chinese occupy and cultivate the alluvial bottoms along the road, while the Lolos pursue their pastoral calling in their mountain retreats. Many of the Lolos, especially women, carry loads of coal in baskets for

the Chinese. The potato is a good deal cultivated in the Lolo country, though the Chinese do not value it much as a food. Its introduction is said to be due to the missionaries, and to date from about half a century back.

Near Lu-Kụ a high-class hæmatite ore is smelted for the manufacture of cooking-utensils, swords, and agricultural implements.

A few miles beyond, we left the beaten road, and, after crossing a ferry on the An-ning river, entered the busy little market town of Sha-a-ba. Another long day's journey brought us across a formidable pass, from 12,000 to 13,000 feet high, and into the valley of the Ya-lung. We left the Wai-yuan at Sha-a-ba to form a link of communication with the outer world, as we had received despatches of a disquieting character relating to the Boxer rising; but we resolved to go on with our work, as, in the event of a Chinese anti-foreign movement extending to this remote district, we reckoned that we were probably safer among the Lolos than among the Chinese.

At Ma-ha, 360 miles from Cheng-tu, the inspection of the gold-mine famous throughout China, and such other mines as we could reach, and preparations for a journey to Burma, occupied us from July 14 to August 10. There are Huntingdon mills and eighty head of water-mills of the rice-mill type. Our residence at the mine was about 9000 feet above the sea, within sight of the Ya-lung river, whose silver streak lay 4000 feet below us, though it was often concealed by a fairyland of fleecy clouds, whose upper surface lay below our dwelling. Telegrams (long delayed) had given an account of the capture of the Taku forts, the troubles at Tien-tsin, and the march on Pekin, where it was said (though we now know that it was exaggerated) that all the foreign residents had been massacred. We were told that the consuls were about to leave Chung-king for Shanghai, with all the foreigners whom they could collect, and that the British consul "most strongly advised" us to go to Burma. Finally, there came a telegram of July 27, that "Foreign Office, London, wired yesterday. Instructions issued take all steps remove British subjects from China." This left us no option, and, our arrangements for providing money, mules, and guides having been completed, we set out (on August 10) on our last journey in China, this time in the character of fugitives.

Torrents of rain descended as we literally slid down a spur of the mountain to the village of Mu-li-chang, on the left bank of the Ya-lung (4863 feet). Half a mile above the village we crossed the river the following day in a boat, the ponies swimming. We put up our tents beside a farmhouse called Hoang-ta-ping, on the right bank, opposite Mu-li-chang. Next day, while it still rained heavily, we had to gain a "main road" which we had seen from Ma-ha, high up on the mountain-side. The ascent was very toilsome, and even dangerous. A mule loaded with my papers and silver ingots slipped and rolled down

100 feet, but the ingenious Chinese pack-saddle came off before the mule had made many somersaults. Having reached a summit level of 7550 feet, we descended to a rivulet whose valley can be seen from Ma-ha. The road led up this creek, but was mostly either under water or washed away. Men and animals had to cross a raging torrent, with a bed of boulders or rocks, seven times within half a mile. After 2 miles of this sort of travelling, we left the rivulet and reached a patch of cultivation at 8400 feet, where we were regaled with delicious potatoes. The road attained a summit level of 10,000 feet, and at length wound down by grassy slopes to the village of Lo-ko-ti (9118 feet). The distance covered in ten hours was estimated at 10 miles, but we were still only 5 miles from Mu-li-chang. We camped in tents at the end of the village street, and our Chinese following had the run of the inn, which had a raised wooden floor, walls lined with sleeping-berths, and a great fireplace with two boilers in the middle. The innkeeper was the fortunate owner of a great deal of land, a silver-mine, and five wives. The inhabitants are said to be of mixed Lolo and Sifan origin, and are a little darker than the Chinese. The men are clad in sheepskins. The women have a flowing dress gathered in at the waist by a silver-buckled belt, and a "Tam-o'-Shanter" cap, and are loaded with silver and jade ornaments. Married women wear a broad silver ring on the usual finger.

In 2 miles, the road, after ascending 700 feet, brought us back to the rivulet which we had left the previous day, and a good part of the day was devoted to wading up its bed for the next 5 miles. In one place we were confronted by a waterfall, and had to pile up stones below it till a footing could be made for the pack-animals. A bear was seen among the trees on the bank, and we also saw a herd of yaks.* After climbing out of the valley, we had to camp, in the dark, at an elevation of 13,000 feet, and without water, although plenty of rain fell during the night. Down a spur, 2000 feet, into a gully, and up again to the same level, we found at last 7 miles of good travelling along a grassy ridge with a few patches of pine. We gathered some ripe raspberries and blackberries. Strawberries had been seen, it may be said, two days before, on patches of old cultivation. In 3 miles more we descended to the village of Shu-pao-pu-tze (8760 feet), and put up our tents. The Sifan inhabitants had fled on our approach, with the exception of a few old men and women. We learned afterwards, when they returned and friendly relations had been established, that we had been suspected of murderous and cannibalistic designs. Opposite the village, from a cliff of white marble 5000 feet high, an almost continuous fall of stones kept up a not unmusical tinkling.

* Yaks, it may be mentioned, were very common in the Min valley, though rare in these parts.

Next day the road wound up to a pass 14,000 feet high, with cliffs several thousands of feet higher in the immediate neighbourhood, and then descended by acute zigzags for 4500 feet, in a single mile, into a valley. This valley, which is without water for at least 5 miles, and has not even a definite watercourse, and which is enclosed by walls of 1000 or 2000 feet in height, fell, if the word may be used, into a large rushing stream, believed to be the same which we had headed and on which Shu-pao-pu-tze is situated. Crossing to the right bank

GORGE ON FU RIVER, WITH COVERED BRIDGE.
(*R. Lockhart Jack, photo.*)

of this stream by a covered bridge near a monastery and a natural tower very like the Nelson monument at Edinburgh, we camped in a Chinese farmer's house in the village of Ta-pu-tze (7670 feet). The Lolo dwellings in the lower part of the dry valley are either caves pure and simple, or caves and overhanging ledges, improved by the addition of a "lean-to" of wood or mud and perhaps a rough paling.

A pass between Ta-pu-tze and the next village, Mai-tze ping, was held by a party of Lolos armed with swords and spears. They let us

pass, but our arrival in Mai-tze ping was the signal for a threatening uproar. It appears that we had been taken for allies or mercenaries in the service of the rival village of Ta-pu-tze, and it was not till a Chinese merchant was found, who could interpret the explanations of our interpreter, that peace was restored. Ta-pu-tze and Mai-tze ping cherish an "old grudge" dating from twenty-two years ago, when robbers from Ta-pu lifted four goats from Mai-tze. A few days before our arrival Mai-tze had been robbed of some silver, but two of the robbers had been captured, and were to be sent in chains to Kwa-pit, though a hundred merry men from Ta-pu had made an unsuccessful attempt to rescue them. The village is built on a portion of the hillside too steep and rocky for cultivation, the houses perched on stone terraces, with the byres and stables on the ground floor and the living-rooms above. The head man's house, in which we lodged, was a perfect arsenal of matchlocks, swords, spears, and daggers. The inhabitants were excessively polite, and made the usual presents in Chinese fashion. Their interest in our firearms was profound and respectful.

In two days we had crossed a pass about 12,000 feet high, where we noted the presence of evergreen oaks, junipers, silver birch, rhododendrons, and bluebells, and were met by a red-umbrella man and trumpeter conveying the welcome of the Tussa of Kwa-pit, who had been informed of our approach. At the gate of the Tussa's stronghold we were received with a salute of five guns—more were to follow, but we begged the gunners to desist in the interests of our ponies. The Tussa, a distinguished-looking young man, received us with great ceremony, and heaped every possible kindness on our heads, inviting us to make a long stay, and especially to wait for a tiger-hunt. We were the first foreigners who had ever been within his gates. His family name is Pu Ta, and his official name Chi King Liong. He said his family had been hereditary chiefs for 630 years, and were of Mo-so stock, having conquered the Kwa-pit district inch by inch. Pu Ta had a pair of feathers and the yellow jacket bestowed upon him by the Emperor in recognition of his services against the rebel Li Sieh in Yun-nan four years ago. The castle, on cliffs like the ancient stronghold at Edinburgh, is built on a platform surrounded for the most part by formidable cliffs defended by a wall, in which time has made so many breaches that the frowning gate is no longer the only practicable entrance. The doorposts are hung with an array of raw-hide straps and bamboos, emblematical of the terrors of the law. On the platform of the court-room are six long swivel guns of 1½-inch calibre and a 4-inch "carronade" on a wheeled carriage, made at Cheng-tu ninety years ago, while two rooms and a courtyard form an arsenal or museum in which are the arms accumulated by thirteen generations of rulers, commencing with crossbows and ranging through flint-locks, matchlocks, arquebuses, blunderbuses, and gingals to Winchester rifles,

besides every gruesome oriental form of cutting and thrusting weapon. The private chapel or temple within the walls was evidently very old, and was full of valuable bronzes and china vases, suits of leather-plate armour, and stuffed bears and leopards. It also contained a very old book in Lolo characters, evidently held in great veneration by the attendant priests.

We saw some of the ladies of the Tussa's household, but of course were not introduced to them. Some were Chinese and some Lolo. One of the latter had an Italian type of features, and was artistically painted—not overdone like the Chinese beauties.

On the second and last night of our stay we witnessed a trial for murder, the accused being two men and two boys. The proceedings were orderly and dignified, and the accused, after having had their fetters undone, were allowed to give evidence. One boy-witness, who was evidently prevaricating, was lightly bambooed. The Tussa seemed to weigh the evidence with great care, making notes and occasionally interrogating the witnesses. The upshot was that a true bill was found, and the prisoners were committed for trial at Yen-yuan. Why the Tussa did not settle the case was not clear, as he undoubtedly has the power of life and death. I fancy that he is a humane man, and that such measures are distasteful to him.

At Kwa-pit, we found ourselves, to our astonishment, near the right bank of the Ya-lung, which was in flood and flowing to the north. Four months later, on comparing notes, in Shanghai, with Captain Davies, I learned that he had been compelled by the remarkable bends of the Ya-lung, when travelling from Mien-ning to Chung-tien, to cross the river three times, a few miles north of our course. Our *route* from Ma-ha to Kwa-pit, by which we accomplished 73 miles in nine toilsome days, cannot be recommended. The roundabout way (in part followed by Hosie) *viâ* Ning-yuan, Yen-yuan, and Yen-ching, would probably take no more than half the time.

Southward from Kwa-pit to Ka-la-ba (25 miles) was fairly hard travelling, not improved by a deluge of rain. We lodged at Ka-la-ba in a Lolo tribal dwelling. A well-built mud house was enclosed in a high wall, in one corner of which was a loopholed watch-tower. The house formed a quadrangle, three sides consisting of byres and stables, and a fourth forming the women's quarters, the enclosed square being roofed in as a dwelling for the men, who in the daytime tended extensive herds of cattle. We shared this sleeping-accommodation, which had two central fireplaces and no chimney, with about 150 men, whom we found good-humoured and intelligent, taking an intense interest in such pictures of "foreigners" as we could show them, and, above all, in our firearms. Their own collection of antique arms—rich in matchlocks and tiger-spears—was extensive and imposing.

A few miles before reaching Ka-la-ba we had emerged on open

downs, traversed by a wheel road which runs to Yen-ching. The principal traffic is in firewood for the salt-works, which is carried in light waggons, with a pair of solid wheels, drawn by bullocks.

A portion of the plain was seamed with rifle-pits, and the explanation given was that this was the scene of one of the Tussa's great battles.

Yen-ching is 19 miles south of Ka-la-ba, and the novelty of covering such a distance in a single day was highly appreciated after the mountainous travelling which had gone before. Hosie, who reached the place from Ning-yuan, calls it Pai (or north) Yen-ching. The town is a very busy one. We saw four salt-wells on the left bank of a rivulet. A good deal of wood is used in the evaporation of the brine, but the greater part of the fuel is lignite from a bed, at least 15 feet in thickness, which we visited at Ho-shau pu, 3 miles to the west, meeting on the way thousands of donkeys, mules, and horses, and some men and women, all loaded with lignite. Another centre of the salt industry is at Yen-tang, south-west of Yen-ching, 32 miles by a circuitous and hilly road. It is on the left bank of a river, which we first crossed between Ka-la-ba and Yen-ching, and is now a considerable stream, no doubt a tributary of the Ya-lung, towards which it flows northward. The brine is reached by two shafts, one of which is vertical, and the other on an incline of 45°. In the former the brine is pumped by five successive stages of 15 feet each, in the latter by seven of 9 feet, and conveyed in wooden flumes to the village, half a mile distant, where it is evaporated. As the fuel is exclusively timber, the manufacture must be much more expensive than at Yen-ching. We were informed by La So Tung, the Tussa of Tung-Su, owner of the Yen-tang wells, that their annual output is 100,000 katties of salt (130,000 lbs.), and that the output of Yen-ching is about 900,000 katties.

On the day's march of 17 miles from Yen-tang to Tai-ye-fang (August 26) we crossed the boundary from Se-chuan into Yun-nan, passing some fortified Lolo farmhouses. The inhabitants are a mixed race of Chinese, Sifan, and Lolo breeding.

To Yung-peh (south-south-westward) the road was over a succession of limestone ridges, pitted with "sinks," by passes varying from 8000 to 11,000 feet above sea-level, the country mainly peopled by Sifans. One lofty plain was remarkable for a crop of edelweiss, almost as thick as clover in an English meadow. Ya-shau-ping appeared, from a proclamation, to be the northernmost village in the "ting" or sub-prefecture of Yung-peh. Two incidents marked our stay here. I was bitten by a dog, and the rain forced us to add open umbrellas to our sleeping-gear, one member of the party having to move his bed owing to the fact that the dissolved mud-wall began to trickle down on him. We had opportunities of judging how degenerate the pear can become

after long neglect. The ripe fruit was no larger than a marble, and gritty and acrid to a degree which made it absolutely detestable.

At the Sifan village of Po-lo-ti, the house in which we camped was entered through the byre, and all the others were of the same pattern. Here a noted horse-thief, long "wanted" by the authorities, was pointed out by one of our muleteers and captured by the escort, who brought him before the head man of the village. The latter, assisted by the village elders, heard the evidence, and the sentence was decapitation

THE WAI-YUAN MOUNTAINEERING AT TUNG-LING-TSE.
(*R. Lockhart Jack, photo.*)

unless the prisoner could find a surety for his good behaviour. At night a group of men and maidens entertained us with a dance.

We approached Yung-peh with some misgivings, as in this Chinese city we thought it probable that, if the "rebellion" was really spreading from the south, our reception might prove less hospitable than that of the friendly Lolos and Sifans. We were met by a messenger from the Sub-Prefect, who requested us not to camp outside, where the country people would fear to entertain foreigners in the then state of public

feeling, but to come right on to the city, where he had got an inn put in order for us. After we had been established in the quarters provided for us, the Ting called unofficially and promised us an escort to Li-kiang. The city is enclosed by a wall, which, if not very strong, is at least highly picturesque, covered as it is with a thick growth of evergreens and flowers. A good deal of the intra-mural space is cultivated, and I should think 10,000 would be a liberal estimate of the population.

The domestic architecture of the Chinese portion of Yun-nan possesses characteristics of its own. The houses are mainly built of sun-dried bricks (with straw), and roofed with tiles. They are decorated with painted top-courses and fanciful designs on the gable-ends. The porches are generally painted, and often have black-and-white landscapes or flower-pieces in panels.

We crossed the Yang-tse (left to right) by an iron suspension-bridge 5 chains in length, 27 miles west of Yung-peh, at an elevation of 4400 feet, below the mouth of the river which drains Po-lo and Yung-peh. The Wu-liang falling into the Yang-tse at this point, as given in Bretschneider's map (followed by the "China Inland" map), is an impossibility. It has been eliminated, I observe, from Bianconi's "Carte Speciale de la Chine," which I procured afterwards in Saigon.

A short distance below the bridge two magnificent springs, each a "trouting stream" in volume, issue from synclinal arches of limestone high up on the right wall of the Yang-tse valley, about a mile below the bridge.

The city of Li-kiang (8070 feet) was reached in two days from the Yang-tse bridge. The distance is only 16 miles, but numerous steep ascents, especially the first from the river, made the road very trying.

Li-kiang is a town of such a peculiar plan that it can hardly have been designed by Chinese, whose cities are of a stereotyped pattern. Some of the streets are very steep, and others appear to have been laid out to utilize patches of bare rock with a view to economy in paving. There is a large open market-place. The population presented a curious problem, as it was composed, for the most part, of Chinese men and Sifan and Tibetan women. The explanation was given that in consequence of anti-foreign rioting at Yun-nan Fu, some missionaries, whom the officials had requested to leave the country till better times, had set out for Ta-li, but had been stopped halfway, whereupon 2500 soldiers had been sent from Li-kiang, with an equal number from Chung-tien, to the scene of the disturbance. The "soldiers" sent from Li-kiang must have been chiefly Sifans. Were the Chinese acting the part of David towards Uriah on a large scale?

The officials were inclined at first to treat us with scant courtesy, sending excuses for not calling and orders by their servants to go to Ta-li. On the second day, as this state of affairs might have become

embarrassing, I went to the Hsien's yamen with the interpreter and argued the matter out. The Hsien firmly refused to be responsible for us if we went to Chung-tien, where, he said, the people were turbulent and strangers were always robbed, and he did all he could to induce us to go to Ta-li. Atentse (Captain Gill's *route*) was impossible because the road was washed away, and for a hundred other reasons. All he could do was to give us guides and an escort to Wei-si, whence we could proceed up the Mekong valley. This appeared to force us too far west, but as we afterwards ascertained that the position of Wei-si is incorrectly given in the maps as west of Shi-ku, whereas it is really north-west, the hsien was in the right.

CH'A-ERH-NGAI, A TYPICAL FLAT-ROOFED MANTZU VILLAGE, MIN VALLEY.
(*R. Lockhart Jack, photo.*)

The Tibetan guide and muleteer, Ta-er-do, who had followed us from Ma-ha, turned back at Li-kiang, taking with him his exhausted animals and his childlike ignorance of the country through which he had professed to guide us. We set out on the morning of September 6 on a west-north-west course, and, after rounding the south end of a lake, reached, in 10 miles, the Llamaserai of Lu-su-ba, where we camped for the night. The priests, of whom there were about a dozen, had been themselves locked out of the principal rooms and the temple, in the absence of the Llama, but they gave us the use of a verandah, on which we made ourselves very comfortable, with the addition of a

tent "fly" hung up to make a fourth wall and keep out the rain. There are some nuns attached to the establishment, but we only saw one of them.

We reached the Yang-tse on September 7, and, after a hasty lunch in a llamaserai at Shi-ku, camped at Mu-chi-ti (6740 feet). At Shi-ku the Yang-tse makes a sharp bend to north-north-east, and I gather from Amundsen's narrative that it must keep this course for about 65 miles before turning to flow southward to the east of Li-Kiang.

The journey up the right bank of the Yang-tse presented no features of note except the large numbers of Tibetan carriers and the style of our sleeping-accommodation, which generally was a hayloft in the upper storey of a farmhouse furnished with the family coffins. We left the river at Ku-tu-wa, on the edge of the Chi-tien plain, and, after a picturesque climb past villages which were always gay with the llama prayer-poles, reached the Llamaserai of Lu-tien (8440 feet). There we arrived a little in advance of the Llama, who was out on duty, but he returned in an hour, and unlocked the best rooms of the establishment and did the honours with a fine old-fashioned courtesy. It was interesting to learn that he, with a great train of priests and coolies loaded with baskets of prayer-books, censers, drums, trumpets, and matchlocks, had been out for three days consecrating an addition to a farmhouse, and that the fee charged was ten taels, or thirty shillings. He was dressed in red serge robes, with a jacket of red plush, and seemed to be about eighty years of age.

The pass (12,000 feet) west of Lu-tien has an evil reputation for robberies committed by bands of men armed with crossbows and poisoned arrows. Our local guard, and most of the travellers whom we met, were armed with crossbows.

A steep descent brought us to Wei-si (7480 feet), a large village or small town, nominally a ting, or sub-prefecture, and the seat of a Hsien, or District Magistrate. The main street is paved and very steep. The town population is mainly Chinese, while the suburban and labouring classes are for the most part Sifan or Tibetan.

Following a tributary of the Mekong to the north-west, we passed Ka-ga, the scene of Cooper's imprisonment, forced marriage, and other adventures during the Mohammedan rebellion, and reached the Mekong in two days. It may be noted that all the bridges between the Yang-tse and Mekong are wooden cantilevers. The Mekong itself is spanned by numerous single-rope bridges of the so-called Himalayan type.

At Hsiao (Little) Wei-si we were fortunate enough to meet the Abbé Tintet, missionary "*apud* Tibet," who had been on the spot when Prince Henri of Orleans passed through on his way to Kampti, and had since read the account of the journey. He impressed upon us the difficulties of the *route* which we proposed to follow—starvation, sickness, uninhabited wastes, snowfields, tigers, hostile Tibetans given

to cutting rope-bridges, and so on. One of his own missionary colleagues was living in a state of siege near Chamutong. So late in the season the snow might be expected any day, and if we did not perish in the mountains we might have the luck to get back and put in the winter at Chamutong. There was, besides, the certainty that our Chinese followers, demoralized by the tales they had swallowed, would desert us in a body. Reluctantly admitting the force of the Abbé's arguments, we gave up the attempt on Kampti. The Abbé informed me that Major Manifold and Captains Ryder and Davies had passed through Wei-si in April, 1900; and, after an unsuccessful attempt to

PEAK NORTH OF LI-KIANG FU.
(*Watts-Jones, photo.*)

reach Kampti, had gone eastward *viâ* Li-tang. As their party had a sepoy following, while ours was Chinese, and one of us (Mr. Way) was crippled, we felt that we were not likely to succeed where they had failed.

Our return journey to Shi-ku was marked by no incidents of importance, except the loss of Mr. Way's riding-mule, which was stolen from the stable during the night of our stay at Wei-si. The magistrate made a great show of zeal for its recovery, giving orders for the closing of the city gates. The gates, in the absence of a wall, serve little purpose except that of ornament, and it is needless to say that the mule was never recovered, though it is a consolation that the magistrate

acknowledged his liability for its value. Once more we escaped robbery at the hands of the cross-bowmen of the Mekong-Yangtse pass, perhaps owing to the showy guard which accompanied us. From the pass, which still retains the scars of the entrenchments which played an important part in the Mohamedan rebellion, a clear day enabled us to see and take compass bearings to a series of snow-clad peaks in a range occupying the bend of the Yangtse north of Li-Kiang. Subsequent cross-bearings from Kien-chuan enabled us to locate these peaks with an approach to accuracy. I am led to assign to the highest of these peaks an altitude of about 20,000 feet by the following considerations. The winter had not set in, no snow had fallen, and the heat of the sun must have been daily melting the lower snows. As long before as May 30, we had found the snow-line at 13,000 feet in the pass of Hsueh Shan, five degrees of latitude north of where we were now. After leaving Ma-ha, we had passed close to heights of at least 15,000 feet, on which there was not a particle of snow, and of course we were prepared to find the snow-line rising as we approached the equator. I am ready to maintain, with the confidence born of long experience, that the highest of the peaks visible from the pass rose at least 5000 feet above the snow-line.

Besides the peaks to the east, we saw from the pass a line of snowy peaks between the Mekong and the Salwen.

Leaving the Yangtse at Shi-ku, we reached Kien-chuan on September 23. The Hsien informed us that he had received a despatch from the Viceroy enjoining him "carefully to protect all foreigners, including missionaries, as China was now on friendly terms with all nations." Entering into the spirit of his instructions, he not only provided the usual local guard, but sent a courier ahead of us to post up a proclamation to the effect that we were neither missionaries nor consuls, but good people who had been sent for by the Empress to assist the Chinese in opening their mines, and were now returning to our own country. We found this proclamation at Tai-ping pu, six stages on.

Adhering to our policy of avoiding the large cities, we left the Ta-li road a few miles beyond Kien-chuan, and followed, in a southerly direction, the river which flows through Yang-pi into the Mekong. This valley has numerous villages and small towns, but there are many evidences of a much greater population prior to the Mohamedan rebellion. The paved and neglected road was unusually bad, even for China, and, not unnaturally, our people were inclined to dawdle on various pretexts. An attempt to hire local guides disclosed the singular fact that there was "no purchase in money," as nothing but cartridges (which we were not prepared to part with) would tempt them.

At Chau Ho we saw rock-salt. So far as I know, this is the only place in China where the rock is worked, although brine-wells are plentiful.

At Yang-pi, where we joined the main road from Ta-li to Bhamo, we

heard of a curious effect of the state of unrest. The small local officials had been notified that, in consequence of the Boxer "rebellion," they were to omit their annual visit to headquarters, so that the usual promotions and honours (buttons) were missed for the year.

At Tai-ping pu the telegraph line from Yun-nan Fu was met with. It followed the road to Bhamo. It was in a marvellous state of bad construction, disrepair, and neglect. At Bei-to-pu we were rejoined (October 1) by a corporal of the Cheng-tu escort, who had been sent from Kien-chuan round by Ta-li with telegrams. He reported that he had found the city strongly guarded, and that he had been strictly examined by the civil and military officials on the subject of his rela tions with foreigners and our business and associates. It was only when it was elicited that we were on visiting terms with General Chi of Cheng-tu (who had been "out" with Gordon, and who turned out to be a friend of the Brigadier-General), that the telegrams were sent and he was allowed to proceed.

There is no need to describe the often-described road from Yang-pi to Teng-yueh. In the map I have adopted a survey of the road made for the Telegraph Department by a Danish surveyor, and which is, no doubt, more correct "than any heretofore." At Yung-chang our credentials procured for us a friendly welcome from the officials, in spite of a deputation of the leading men of the city, who demanded that the Hsien should inquire carefully into our antecedents, and if we were found to be missionaries, runaways, or bad characters, should send us back to Ta-li. A herald was sent ahead of us to Teng-yueh to proclaim, with beat of gong, in all towns and villages, the harmless and even praiseworthy nature of our mission. A further difficulty presented itself, which threatened to have serious consequences. A corporal had been sent ahead to make a bargain for fresh mules, but when we arrived the head muleteer repudiated the bargain on the ground that his "Union" forbade carrying for foreigners. The Hsien, with whom we had become friendly, sent for the ringleaders, and, failing to convince them that we were an exceptional kind of foreigner, awarded four of them two hundred blows of a bamboo each. We were hardly prepared for the employment of this argument, and were greatly relieved when the muleteer who had served us till his beasts were well-nigh spent volunteered to take us to Teng-yueh. Here also our Chinese followers, with a few exceptions, having been "crammed" with tales of the dreaded "fever valley" (the Salwen), declared their intention of leaving us. It appeared that they were almost certain to die. If not, one account said that their wives would prove unfaithful, and another that it was the custom among men contemplating the feat to write to their wives beforehand and give them permission to look out for other protectors. To the argument that strong young fellows were more likely to survive than an old man like me (in China one soon learns to make

the most of the *prestige* derived from age), a soldier returned the answer that "foreigners were very strong in their insides." It was only after two days of weary argument, and the promise of a pill which would make them fever-proof, that the men were induced to go on.

The Salwen was crossed (October 10) without so much as a headache, the promised pill having first been duly exhibited. I have seldom seen a prettier valley, nor one which I should have expected to be more healthy. The valley is cultivated, and is crossed daily by crowds of carriers; but it has got a bad name, and my belief is that many Chinese die of sheer "funk" in crossing it. From Marco Polo to Gill and Colquhoun, travellers have borne witness to the popular terror inspired by the place. We saw a village at the western end of the fine suspension-bridge over the river, which had been burned down a few years ago on account of an outbreak of plague, the inhabitants having migrated to higher ground. Where in China has plague *not* broken out one time or other?

Teng-yueh has a good deal of waste land within the walls, but is still a populous city, the chief industry being that of the lapidary. Jade-cutting and jade-speculation seem to employ the energies of the greater part of the populace. There was said to be an army in the city "watching the British frontier." The Chun-tai, or General-in-Charge, who was said to be burning to avenge a "massacre" of a "simple pastoral people" on the border by sepoys, and to be only waiting for orders from Yun-nan to march against the British army, seemed reluctant at first to do anything for us, but the Ur-Fu (Assistant Prefect) stood our friend, and ultimately we were furnished with a safe-conduct and an escort, under an officer of higher rank than usual. It is almost needless to say that at Bhamo we heard quite another version of the border affray.

Beyond Nan-tien, a stone bridge crosses the river which we had followed down from Teng-yueh. The road to Manwaing formerly crossed this bridge and followed the right bank of the river, and many previous travellers have described it. Within the last few years, however, the Chinese have abandoned it to the "wild men" (Shans or Kachins?), and kept to the road on the left bank. At Lang-sung kwan, a bridge is being built over a large tributary stream, and, if it is ever completed, will be a great work. The deck, of squared stones, is supported by pairs of squared stone posts mortised into squared stone beams.

Shan villages now became numerous, but any description of them is rendered impossible by the custom of barricading the ends of each and forcing the public road to go round the outside. They are generally surrounded by a mud wall and a clump of well-grown bamboos. The roads are often lined with shade trees—an idea which does not seem to have occurred to the utilitarian Chinese mind.

The Tussa of Muang-la, a great chief among the Shans, had heard

of the approach of a party of foreigners, and no doubt our numbers had been greatly exaggerated, and he could not tell whether we were friends or foes. His stronghold is on the right bank of the river; but on our arrival at Ju-chen on the left bank, we were met with the information that he had sent his brother to warn the townsmen that we were to get neither food nor shelter. The awkward situation was relieved, before matters had become serious, by the arrival of the belated officer who carried the Teng-yueh general's safe-conduct. We were then invited to occupy the Tussa's shintai (guest) yamen, which was unusually sumptuous. The Tussa is literally "Lord of Two Elephants," which

WOMEN OF LI-KIANG FU.
(*Watts-Jones, photo.*)

were much admired by our Chinese following, who had never seen such animals before. They were carrying enormous baskets for the reception of the dues which the Tussa exacts from every market. If my information was anything like correct, he must derive an income of about £7000 per annum from this source alone.

Near Ju-chen the river which we had followed down from Teng-yueh falls into the left bank of the Tai-ping Ho. The latter, a broad and sluggish stream, is navigable for boats down to beyond Manwaing, but a short distance below the town it tumbles through gorges in which it must fall something like 3400 feet to Myothet.

According to Bretschneider and Bianconi,* the Lung-kiang rises

* Bianconi's 'Carte de la Chine, Physique et Politique,' is published at Paris without date, but evidently recently.

further north than the Tai-ping Ho. This is probably a mistake, as it is a smaller river. So far as I can discover, no European traveller has seen the head of either.

We crossed the Tai-ping by a ferry above Manwaing, and spent a night in that flourishing town, which owes its prosperity to its position as a depôt for the carrying trade on the Chinese side of the range dividing it from Myothet in Burma.

Our interpreter told us that the question of the hour in Manwaing was, "Why did not the Chun-tai at Teng-yueh kill these foreigners instead of sending soldiers to protect them?"

At a creek 2 miles below Manwaing is a monument to the memory of Margary, who was murdered in 1875, by the "wild men," according to the Chinese, although the evidence leaves little doubt that the murder was done by order of the Chinese officials. Here the river enters into gorges, and the road leaves it and ascends, to an altitude of 5070 feet, a series of ranges inhabited by Kachins.

The Kachins, a predatory tribe, used to attack and rob the Chinese, till, by the intervention of the British, they were induced to compound for their right to rob by a toll on travelling merchandise. The Chinese say that this peaceful levy was little to the liking of the Kachins, who gradually lapsed into their ancient habits. Till 1896 they were very "bad," and carriers used to wait till they were at least 200 strong before crossing the mountains, but since then a chain of forts and garrisons had been established to keep the road open. We were hospitably received at some of the garrison villages (kwans). We counted six fortalices within as many miles west of Pongdsi. They are blockhouses surrounded by double trenches and *chevaux de frise*.

The Kachin villages often consist of a single long house with straw roof and wooden floor, used as a common dwelling. According to the Chinese, the Kachin men do nothing but "walk about with a gun and a knife," while the women do all the work, which no doubt means that the men live by hunting. We observed a great preponderance of women in the market. Near Pongdsi we noticed a number of elevated chairs and couches, too lightly built for human seats, and were informed that they are used on festive occasions, when idols are enthroned and invited to partake of the slaughtered cattle.

On October 20 we crossed the Hung-ma Ho and were in Burma, the Sepoy guard offering convincing evidence that we were at last clear of China, and once more under the British flag. We camped at the telegraph-office, and communicated with friends in England and Australia. The following day we crossed a jungle-clad range, and reached Myothet at noon. Myothet is the head, or nearly the head, of boat-navigation, and so cannot be much above the level (430 feet) of Bhamo. The overland journey from Ma-ha totalled 874 miles, and had

taken us 73 days. We hired a boat, and dropped down from Myothet to Bhamo on the Irawaddi in about six hours.

Bhamo is universally known on the Chinese side as Sin-kai. For three weeks we had been hearing of Sin-kai, which we had been led to believe was some place on the Tai-ping river, and it was from the Chinese telegraph-master at Manwaing that we first learned the truth. Incredible as it may appear, the name Sin-kai was unknown to the civil and military authorities of Bhamo. We learned afterwards that Colquhoun had "discovered Sin-kai" some years before us.

Our followers, having been paid, revelled for a few days in the joys of shopping and riding in "gharries" before starting on their long home tramp, varying from 500 to 1500 miles, on which I have since learned that three of them died. Only the interpreter and the cook and boy accompanied us to Shanghai, to which we returned *viâ* Saigon, after short delays in Bhamo, Mandalay and Rangoon. As events turned out, it is possible that, had we known, we might have reached Chung-king in safety, and found shelter on the *Pioneer* steamer, which, after her first trip up the rapids, was "commandeered" as a British gunboat.

Travelling in China is not exploring. There is probably no portion of that great country which is not well known to some timber-getter, hunter, or medicine-collector, each in his way as much of an expert as any Australian or African bushman. There are even official maps of every province, but beyond conveying in diagrammatic fashion some idea of the relations of river systems and mountain chains, they are of little value for geographical purposes. In the map attached to this paper, there will be found some additions to our knowledge of the geography of a country which, however well known to the natives, is but little known in the West. These additions are chiefly in the valleys of the Ya-lung river, the upper Yang-tse, and the tributaries of the Mekong, and include an approximate location of some ranges which rise above the snow-line. It is to be regretted that, owing to the attitude of our Chinese following towards them, our intercourse with the interesting Lolo, Sifan, Tibetan, Shan, and Kachin races was very restricted; but still, though, from our inability to enter freely into conversation with these people, we had to travel among them very much as deaf and dumb men might, we enjoyed some opportunities of observing their dwellings and customs.

The question of railway communication between Burma and Western China is bound to become acute within a very few years, in spite of the attitude recently taken up by the Government of India. At present a British railway approaches the Chinese border at Kun-lung on the Salwen, and a French railway at Lao-kaï on the Red River. I do not regard either as a strategic railway from a military point of view, but from a commercial standpoint, the question of which country first

obtains a footing in Western China is of the highest importance. The French aim is Yun-nan Fu and the Yang-tse, while the British is Ta-li Fu and the Yang-tse. They are both perfectly legitimate commercial aspirations, but if the French get to Yun-nan Fu while the British do not get to Ta-li Fu, a formidable barrier of French "influence" will be interposed between Burma and Western China. Both lines will be difficult to construct, and perhaps the British line will be more difficult than the other, although there are only two ranges between Kun-lung and Ta-li. After all, the distances, as the crow flies, are about equal—160 miles from Kun-lung to Ta-li, and 165 miles from Lao-Kai to Yun-nan. No traveller who has seen the long caravans of coolies and mules carrying the products of the West—petroleum, candles, steel, tinned milk, tobacco, wool, cotton, and umbrellas—from Bhamo to Ta-li in spite of the frightful difficulties of a badly engineered and ill-kept road, can doubt that even now a desire to trade with Burma exists in China. To Western China the navigable Irawadi *is* the seaboard, and for that reason the possession of Bhamo (Sin-Kai) has been an age-long aspiration of the Chinese. The coming rejuvenescence of China has to be reckoned with. Whatever the Japanese have done, the Chinese are capable of doing. After they have had a couple of generations of such progress as the Japanese have made, it would surprise me if the western Chinese do not propose to build railways to give themselves the necessary communication with the sea through Burma and Tonkin.

Before the reading of the paper, the Chairman, Sir Henry W. Norman, said: I am sure you will all be very sorry to hear that Sir Clements Markham, owing to slight indisposition, is not able to be present here this evening. Dr. Jack will now read a paper containing an account of his journey from Shanghai to Bhamo. I may just mention that Dr. Jack is an old acquaintance of mine, having served in Queensland as a geologist of considerable repute under the Government, not only during the time I was there, but some years before, and for some years afterwards. I will now ask him to read his paper.

After the reading of the paper, the following discussion took place:—

Mr. A. R. Colquhoun: The paper read this evening by Dr. Logan Jack forms a most useful addition to our knowledge of a most interesting and, I may say, fascinating part of the world, and I am sure we all regret that the troubles which occurred during the time of Dr. Jack's visit made it necessary for him and his companions to leave before he was able to complete his studies. There arose out of these troubles one fortunate result, namely, that Dr. Jack and his companions were compelled to make their exit from China to Burma through a most difficult and most dangerous country, large divisions of which had before never been trodden by the white man. I think it must be of interest, and it must be also extremely gratifying to the Fellows of this Society, to remember that among the many explorers who have spent their energies in this region of North-West China, no fewer than three or four medallists of this Society can be numbered, and to those may be added a very large number of Fellows who have done good yeomen service in both Sechuan and Yun-nan. I merely recall the names of Augustus Margary, Captain Gill, and Colborne Baber, and among the very many Fellows,

whose name is legion, I venture to recall that of a lady—I believe she is a Fellow —at any rate a lady who has read most admirable papers before this Society, namely, Mrs. Bishop, the well-known traveller. Dr. Jack has drawn our attention this evening to the most wonderful scenery that is to be witnessed in South-Western China, of which we have had a great number of examples, and I can bear testimony to the accuracy of Dr. Jack's remarks in this respect. We must all hope with Dr. Jack that some of our artists, when they have exhausted the hackneyed ground of Europe, may find their way some day to this fascinating region, and bring back to this country reproductions of some of the most wonderful scenery to be found in the whole world. It is interesting, I think, to note that in this immense province of Yun-nan, the most south-western of the whole of China, during the Boxer troubles which occurred a couple of years ago, this country had not one single representative in this huge province, and the representation of this country actually devolved upon a very junior member of the Chinese Customs Service, a young fellow who was then resident at the small border town of Ssumao. It is matter for regret that this country is not more fully represented in the province of Yun-nan. I believe that at present there is one British consul in that province, and he happens to be a most admirable official; but he is relegated to a little out-of-the-way corner in the western part of the province, a place of no importance whatever, and it must be regretted that at a time like this Britain is not represented at the one place in the province where we ought to be represented, viz. the capital of the province of Yun-nan-fu, a place where, I may mention, very important events are in course of evolution at the present time. Some of us would perhaps have liked to hear from Dr. Jack some expression of opinion as to the value of Sechuan, but doubtless his omission to tell us what he thinks of that part of the world is due to the necessity of a sudden return from that country, and we must hope that some day he may be enabled to return there and give us the results of further scientific study. The most important point in the whole of this very important paper of Dr. Jack's this evening is the portion where he deals with the question of railway communication between Burma and the Yang-tse. There is no time here, nor is this the place, to enter into a full discussion of this question, but I may mention that there are many men—and among them myself—men who have studied this whole question, and who have examined it on the ground, who are of opinion that such a railway must and will yet be made. Dr. Jack has alluded in his paper to one very important feature of that question, and that is where he points out the grave danger of what he calls an insurmountable barrier of French influence being created in this hinterland of ours. In conclusion, I thank you for the attention you have given to me, and I ask you to join me in thanks to Dr. Jack for his admirable paper.

Mr. W. R. Carles: I suffer under the disadvantage of never having travelled in West China, but there are two points in Dr. Jack's interesting and valuable paper to which I am glad to have an opportunity of referring. In the first place, I should like to draw attention to its great geographical value. In the map which has been furnished to the meeting, the dotted lines show that much of the course of the rivers is problematical. The dotted lines might even be extended to include almost the whole course of the rivers, with the exception of a few points which have been fixed. Dr. Jack has spoken of "travelling in China not being exploring." He might have said that travelling in China is the correcting of Chinese maps. In the wilds through which he passed, the rivers are laid down in Chinese maps as following a straight line from north to south. The acute angle of the Yang-tse near Li-kiang, where the river takes a long strike north-east, represents a discovery made some seven years since by a French traveller, Mr. Bonin. The similar sharp

angle described by the Ya-lung represents a discovery made by Dr. Jack. The whole of the journey made by him between the Ya-lung and the Yang-tse is over ground which had never previously been described by any foreign traveller.

In speaking of the gold-mines at Hama as well known, I wish to mention that practically nothing is known of the production of gold in China. In one of the best works of modern years on West China, gold is only once mentioned. It is known that a certain amount of gold-washing is done in the beds of rivers in West China, from which the workers derive a very beggarly living, and it is believed that part of the gold obtained finds its way overland to Peking. But there is really nothing known of the production of gold in West China, its annual yield, or the quality of the ore. The only ports which export gold to foreign countries are the northern ports, Newchwang, Tientsin, and Chefu. From the Yang-tse there is no export. The information acquired by an expert such as Dr. Jack would be a very valuable addition to the knowledge of China, and I trust that he may find it possible to give it to the public.

Mr. M. F. A. Fraser: I am afraid I cannot add much to the very interesting paper Dr. Jack has given you as regards land travelling, but I can perhaps give you something interesting about water-travelling, as I have spent some months of my life in the years 1899, 1900, and 1901 in travelling on the Yang-tse river in steamers, and I am of opinion that navigation from Chung-king to Cheng-tu, over 500 miles, with Dr. Jack's permission—he says it is 300 odd miles, but I believe it is 500; at any rate, it seems like it when you are travelling—I believe that this navigation will never be possible in winter, but will only be possible for about six months in the year when the river is full. Even at that time the pilot of the British fleet on the Yang-tse is of opinion that the work is so wearing that no captain could carry on such a business long without becoming utterly exhausted. The whole of the time one goes up and down a series of most frightful rapids, and if Dr. Jack had come down in winter he could have seen something very exciting. It made my hair stand on end. There are drops of 7 feet in a small area, and these are very frequent. From Chung-king to Sui-fu there is a piece of water which is perfectly navigable. I have been on that on the British gunboat which went 6 miles over the ground against the current and 15 with it, while in the *Pioneer* we did, I think, in four consecutive hours 40 miles, 10 miles over the rapids, and so I believe there is a future for steam navigation from Chung-king to Sui-fu, 250 miles; but for the rest I believe there will only be travel for six months of the year. That is all the information I have on the subject.

Captain Pottinger: I have very little to say, except that I was employed on the survey for this proposed railway between Burma and China. While waiting for one of our engineers to join the party, I made a survey through the rapids. I made plans of most of the rapids, and I made notes of how I thought they could be improved. But I must tell you that I am not an engineer, and that my work is only amateur work. What I think of it is that, compared with the expenses of the railway, if money was spent to improve the rapids, it could be done, and that you would get steam communication along it nearly the whole of the year. The traffic of that part of the river is enormous. About 100,000 tons go up every year, and more than double that quantity comes down, and I do not know any place where there is such a great inland traffic. As regards the railway, all my duty was to report whether a railway was practicable, the probable cost, and a few remarks about trade. But as regards the desirability of building it or otherwise, I was not called on to express an opinion. A part of Yun-nan has been described as being very badly populated and very poor. You must remember that before the rebellion that country was well populated, and if it could support a big

population then it could doubtless do it again. From what Dr. Jack has told you, you know how it was populated, and if a series of famines occurred in that district, what would happen to the people? They must either die or migrate to Yun-nan; and I think there is every prospect of Yun-nan becoming as prosperous as it was before the rebellion. Another point: Dr. Jack has told us very little about the mineral wealth—whether he thinks it is worth developing or not. I was struck myself with the vast quantity of minerals which we saw. There was gold, silver, copper, mercury, and all sorts of minerals. All these things have to be borne in mind in talking of the railway communication. And another thing is that the railway will eventually be built to the Yang-tse some day. There is no room for two. Either we shall build it, or, if we do not, the French will. If Dr. Jack would tell us what he thinks as regards the developing of the country from a commercial point of view, I think it would be most interesting.

The Chairman: It is very late, and I am afraid we cannot continue this interesting discussion, though I have no doubt there are other persons here who might tell us something important or interesting. I am sure I shall be authorized by you to convey your cordial thanks to Dr. Jack for the most interesting and important paper that he has read, and also for the very beautiful photographs which have been displayed to us.

THE FORMATION OF THE MALDIVES.*

By J. STANLEY GARDINER, M.A., Fellow of Gonville and Caius College, and Balfour Student of the University of Cambridge.

The Maldive and Laccadive archipelagoes form a long narrow belt, extending down from the coast of India almost from the region of Goa, in lat. 15° 21′ N. to nearly 1° S. The Laccadives occupy the northern half of this belt, and consist of ten reefs with land, four reefs awash, and four submerged banks. Of the reefs with land or awash, nine are atolls, or preserve traces of having at one time had the ring-shaped form. The rest are mere narrow reefs with a certain amount of land and a greater or less extent of shoal-water off them. The three larger submerged banks to the north have depths of 24, 21, and 16 fathoms; the fourth, Elicalpeni, to the east, having only 6 fathoms. The chart, on which we are dependent for their contours, was made in 1860; of course it has been corrected since, but there has been no fresh survey. Although the banks are of considerable size, and although the conditions of life appear, save in the proximity of the Indian coast, to be generally favourable, there is little sign of these shoals assuming a ring-shape, their shallowest soundings being on the centres, not on the rims. There is no direct connection anywhere with the Indian coast, the 1000-fathom line running up between; most of the banks are separated from one another by the same depth, but soundings of 700 fathoms or 800 fathoms only are recorded between some.

Between the Maldives and the Laccadives is a broad strait 175 miles across, broken by the atoll of Minikoi, politically placed in the Laccadive

* Read at the Royal Geographical Society, January 27, 1902.

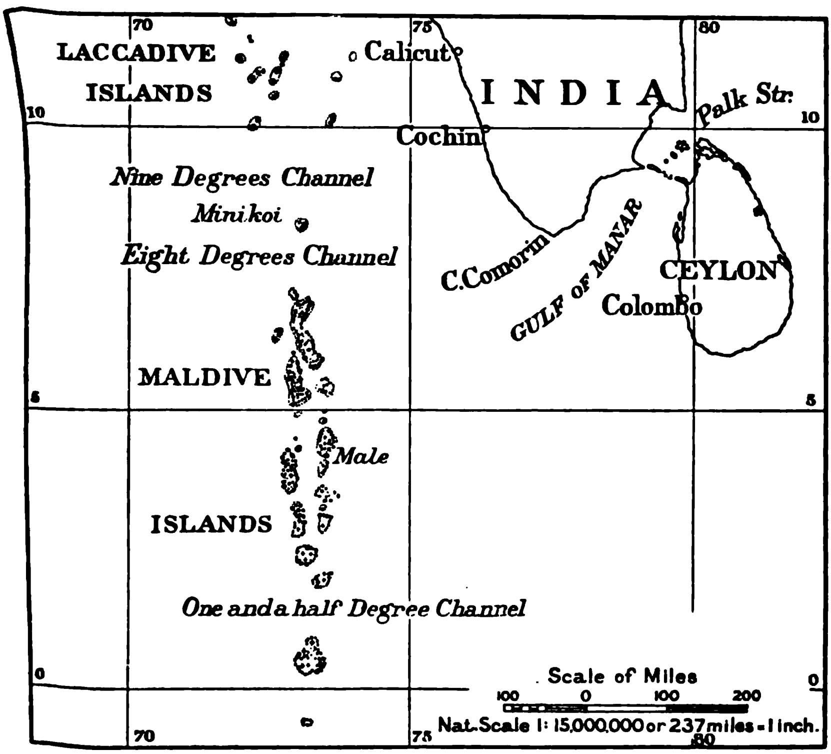
group, distant 110 miles from Suheli Par and Kalpeni to the north, and 70 miles from Ihavandifolu, the most northern atoll of the Maldives. This division does not in any way break down the geographical connection between the two groups. There may be a slight increase in depth—100 fathoms or so—over the 1000 fathoms which separate many of the Laccadive reefs from one another, but between this and the general depth on each side there is in a few miles an additional drop of over 1000 fathoms to the west and 400 fathoms to the east. The Indian ocean, so far as can be seen from the soundings, has in its western half an almost flat bottom at a depth of 2200 fathoms. The 2000-fathom line extends close to the south shore of Ceylon; it is a little further distant from Cape Cormorin, whence it runs down close to the east of the Maldive bank, rounds Addu atoll, and winds up even closer to the west, bending round by Arabia and the African coast.

In 1899 and 1900, assisted by the Royal Society and the British Association, I took a small expedition to the Maldives and Laccadives. Our object was to investigate the interdependence of the physical and biological factors in the formation of atolls. Having visited Funafuti as naturalist to the first expedition in 1896, and subsequently spent nine months in neighbouring coral-reef areas, I naturally took a great interest in the formation of the reefs. My work led me to conclusions so unfavourable to Darwin's theory of subsidence that I had to reject it completely, as applying to the western part of the Pacific.* I still, however, held the opinion that the Maldive reefs were formed by a series of changes from the fringing to the barrier reef, and so to the perfect atoll. No one had visited the region for scientific purposes, since it was surveyed in 1834–6 by Captain Moresby of the Company's service. This officer made most careful and accurate charts, but from his published accounts it would appear that he took little interest in the reefs beyond what his duty required. Darwin, however, was in communication with him, and had the benefit of his experience in writing the first edition of 'The Structure and Distribution of Coral Reefs' in 1842.

My original plan was a much more comprehensive one than that subsequently followed, as it included a full set of soundings round the group and a second visit to the northern Laccadive islands. It could not, unfortunately, be carried out on account of my illness and the increased cost of every commodity, after the war had commenced; the latter, too, prevented my obtaining the services of a steamer for a longer period. As it was, I left England in March. 1899, accompanied by Mr. L. A. Borradaile of Selwyn College, Cambridge, who joined me for certain zoological work. On arrival in Ceylon, we had seven weeks to wait before we could leave for Minikoi, where we were intending to spend the greater part of the south-west monsoon. However, as we had

* See "The Coral Reefs of Funafuti, Rotuma, and Fiji," *Proc. Camb. Phil. Soc.*, vol. ix. pp. 417–503 (1898).

included in our plans a survey of the reefs of Ceylon, we meantime made a traverse of the east and south coasts, and visited the north part and the Jaffna peninsula, all of which is formed of raised limestone. We finally reached Minikoi in the middle of June, and pitched our camp under the lighthouse, the lifeboat of which we used for our work. A survey of the whole atoll was made and large collections obtained; but the work was not as complete as desired, on account of the illness of Mr. Borradaile, whom I had to send to Ceylon on a British India



OUTLINE MAP SHOWING RELATIVE POSITION OF THE MALDIVES.

Company's steamer that came in the middle of July to look after a wreck on the island. I remained, and finally returned to Colombo in the middle of September on the s.s. *Ceylon*, Captain Channer, R.N., kindly giving me a passage. Besides the collecting and survey work, among other points I paid special attention at Minikoi to the currents round the atoll, but much work in the open sea was impossible on account of the heavy storms of the monsoon. The visit was useful as giving a clear insight into the actual condition of a single isolated reef. It also enabled us to prepare more completely and arrange our programme for the Maldives.

In Ceylon I was joined by Mr. Forster Cooper of Trinity College, Cambridge, and we left for the Maldives on October 18, 1899. On arrival at Male we were received by the sultan, who lent us a schooner of about sixteen tons, in which we did the greater part of our work. The sultan, who is a supreme ruler under the protectorate of Ceylon, sent intimation of our expedition to all the thirteen provinces of his group, and told off his third vizier, the *velanamanikofanu*, to accompany us. Our visit was, nevertheless, looked upon with great suspicion, and, although the sultan had given the most distinct orders that we should be assisted in every way, we had to contend throughout against much veiled opposition from the viziers and nobles. Fortunately this was not of much hurt to us, as, our crew, collecting boys and servants numbering sixteen, we were quite independent of the islanders. Indeed, we were able at any time to put a full crew of six into a whaleboat, which we towed about with us, and yet to leave sufficient hands to man our schooner and to dredge.

We sailed without delay from Male to Goifurfehendu atoll, where we visited every part, and made collections with a view to comparing it with Minikoi. November, 1899, a month of calms, was taken up in a slow progress through South Mahlos; but in December, getting strong north-east winds, we were enabled to see more of North Mahlos in twelve days than we had seen in twice that time of South Mahlos; indeed, between us we visited no less than twenty-seven islands, traversed nearly the whole circumference of the bank, and put down over twenty dredgings and a large number of soundings. Crossing to Miladumadulu on December 11, we spent twelve days on that bank, principally among the reefs of the eastern side. Generally we divided forces, Mr. Cooper dredging, while I took our whaleboat and examined the reefs and land. On December 23 we reached Fadifolu, most parts of which one or other of us visited in a stay of ten days. For four days we had to lay up at Naifaro for repairs, our vessel having been severely knocked about in a cyclone we experienced. Finally we left for Male on January 2, 1900, and reached our anchorage there on January 5, having run a line of dredgings down close to the east reefs of the atoll.

The remainder of January and the whole of February were passed at Male and Hulule, a neighbouring island, in making collections and special observations on the currents, tides, and other physical conditions. No work was possible in the schooner for the first half of our stay on account of its being Ramazan, the Mohammedan month of fasting; but in the latter half of February, Mr. Cooper took her, after she had been thoroughly overhauled, for a week's dredging in Male atoll. I meantime had contracted the Maldivan fever, and on March 1 returned to Ceylon in a British India Company's steamer which chanced to call at Male, Mr. Cooper meantime dredging the eastern atolls southwards. I left Ceylon on my return in the s.s. *Ileafaee*, of which Mr. Noorbhai,

a Mohammedan gentleman, gave me a very favourable charter, on April 2, and relieved Mr. Cooper, who joined me in Haddumati. We then had a seventeen-days' cruise in the steamer among the reefs, visiting Suvadiva and Addu, and returning *viâ* Kolumadulu, the two Nilandu banks, and Ari. On our way we put down sixty-seven dredgings, making upwards of three hundred in the whole group. These, together with the reef collections, give a good idea of the marine fauna, but the land fauna and flora were also obtained, two "boys" whom I had trained at Minikoi being especially told off to assist in this work.*

A LAGOON SHOAL WITH SAND ISLAND.

After this premiss it is necessary to return to the Maldives and examine what light its features throw on its own formation. The group may be naturally broken for consideration into three divisions—Addu, Suvadiva, and the remaining banks. The first two are isolated atolls, separated from the rest and from one another by broad channels, the "equatorial" and "one-and-half-degree," the former with one sounding of 1027 fathoms. The two atolls differ from one another mainly in their relative size, Suvadiva covering an area of over 800 square miles, and Addu less than 50 miles; this entails consequences in respect to the various actions still continuing, which further differentiate them. Intermediate to Suvadiva and Addu lies Fua-Mulaku, about which I have no reliable information. It is a reef, the greater part of the surface of which has been converted into land. There are some indications that it may have passed through a phase when it was of atoll-shape, and hence it may be provisionally joined to Addu.

The third division, comprising the main part of the group, and with which I am here principally concerned, consists of a series of banks with a depth of water less than 50 fathoms. Some are surrounded with great

* A full account of the collections and work of the expedition is now being published by the Cambridge University Press in a series of quarto parts under the title of 'The Fauna and Geography of the Maldive and Laccadive Archipelagoes.'

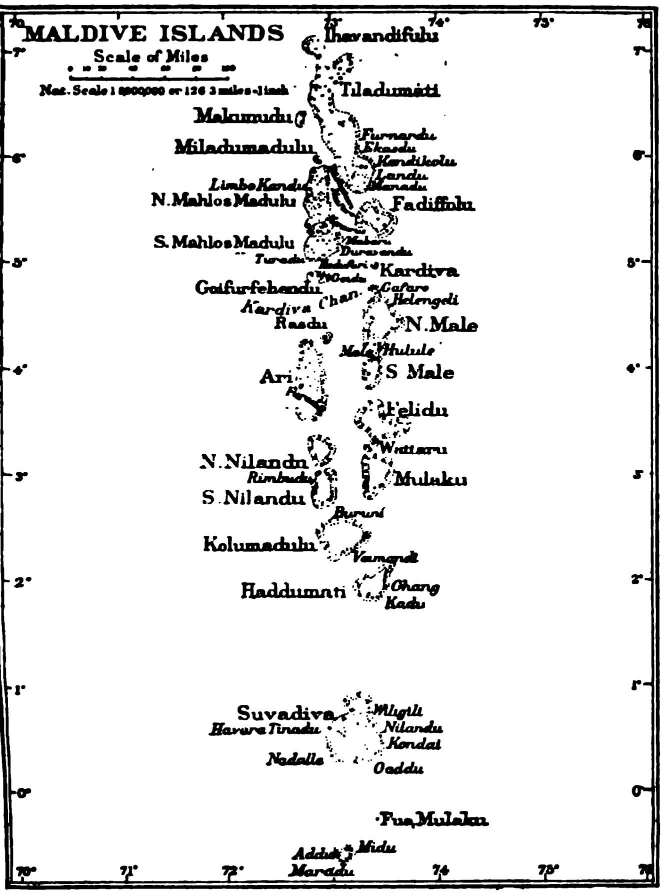
encircling reefs, while others are studded all over with smaller reefs. Of these latter some again are ring-shaped basins with small lagoons—*faro*, as they are called—and others are flat; some have land, but the majority are just awash at the low-tide level. The larger banks form a line, 290 miles long, from north to south, from Tiladumati to Kolumadulu. The line consists of single banks at either end, but of two parallel series in the centre, hence the shape is a narrow oval with blunt points. The different banks are separated from one another by only moderate depths, probably in no case more than 300 fathoms. Ihavandifolu may be an outlier of the division, a least sounding of 601 fathoms having been obtained where the channel is about 8 miles across between it and Tiladumati. Possibly, too, there is a greater depth between Makunudu and either Mahlos or Tiladumati, and there are absolutely no soundings between Haddumati and Kolumadulu.

This large division may be subdivided, perhaps somewhat arbitrarily, into two parts by the Kardiva channel, 28 miles broad, which crosses the double chain between Fadifolu and Gafaro to the east, and Goifurfehendu and Ari to the west. The connections, however, across the channel are clearly indicated by the isolated reefs and islands of Karidu and Toddu east and west. These two resemble Fua-Mulaku, and, like

ROCKY OUTER BEACH AND REEF-FLAT OF ONE OF THE EAST ISLANDS OF NORTH MAHLOS.

it in their development, possibly passed through atoll-conditions. The smaller banks tend to be more or less completely surrounded by surface-reefs, perhaps with land, in whatever part of the group they lie, but the larger banks to the north and south of the Kardiva channel differ from one another in this same quality. To the north the Tiladumati-Miladumadulu bank, 87 miles long by 11 to 20 broad, has, as a whole,

ittle semblance to an atoll, consisting rather of a series of isolated reefs of no great size. Mahlos-Madulu has a more definite sequence of reefs towards its circumference, but there is no real central basin, the inner part being abundantly studded with surface reefs, some with land. Fadifolu is much smaller, and has a nearly perfect reef to the east, but merely a series of patches to the west. To the south of the channel all the banks of the east series have more open lagoons. Their delineating



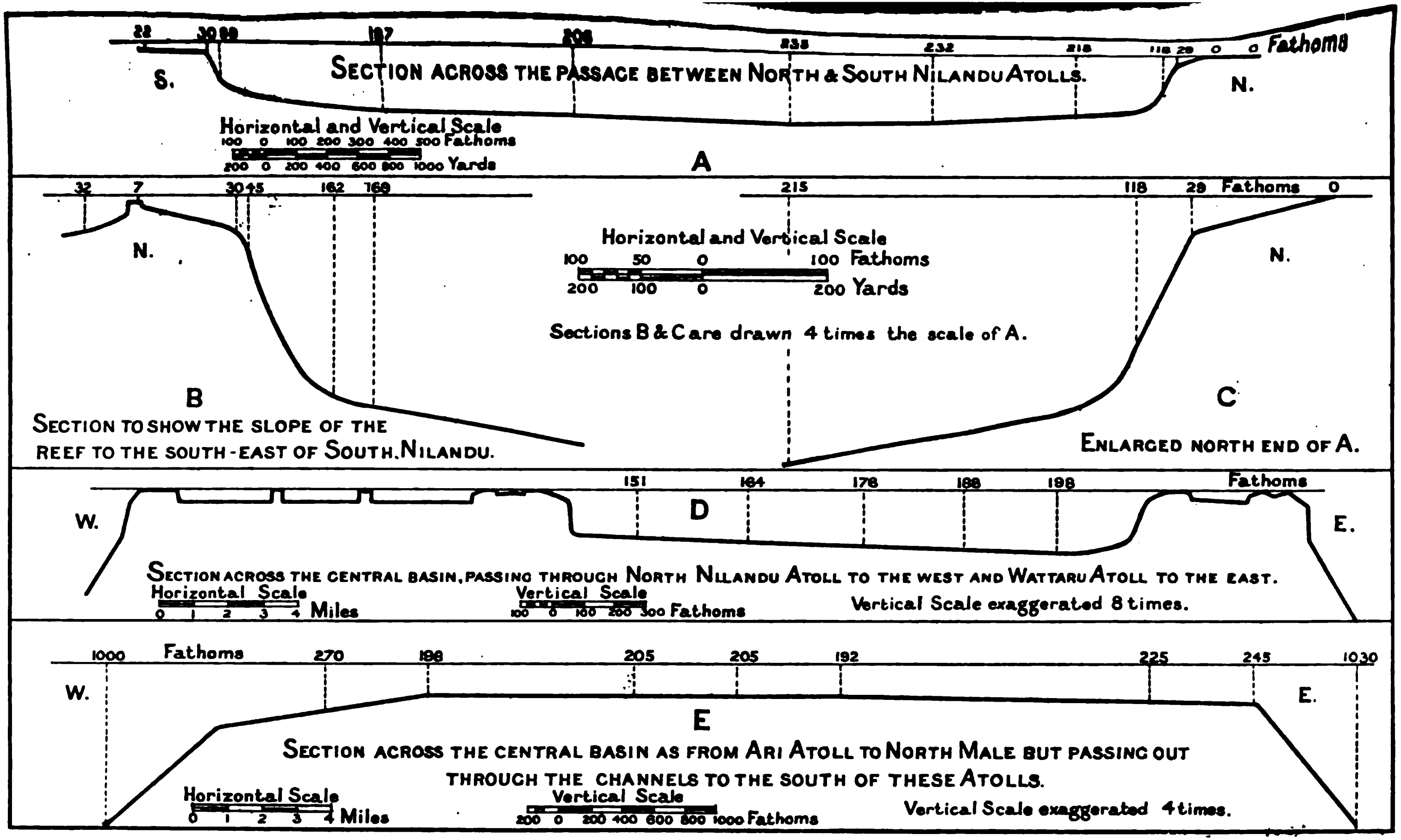
reefs become more defined to the south, until in Kolumadulu is seen a perfectly typical atoll, differing only from the majority of those found in the Pacific ocean in its greater size, being 26 miles in diameter, and covering an area of about 430 square miles. Along the west row the same divergence is not quite so clear, Ari being to some extent interposable between Mahlos and North Male.

Another point of dissimilarity lies in the depths of the banks being

greater to the south than to the north of the Kardiva channel. The average depth on the Tiladumati-Miladumadulu bank is 23 fathoms, Mahlos 25, and Fadifolu 25, while North Male has 29, South Male 25, Felidu 32, Mulaku 32, and Kolumadulu 40. Again, the west line is less marked, Ari having 32 fathoms, North Nilandu 32, and South Nilandu the same. These variations in depths may be due to diverse conditions in the past between the two parts; but, whereas on the large banks the deepest parts are those around which the encircling reefs are most perfect, they would seem rather to be contingent on the greater perfectness of the atoll form to the south. I have no soundings across the Kardiva channel, but from the general contour it is impossible to suppose that there is any geographical separation between these two divisions. Yet there would seem to be a real difference, which was probably due to the diverse physical conditions, currents, winds, temperature, etc., affecting the banks themselves during their formation in different degrees.

The various banks, as they exist at the present day, may be regarded as plateaus, rising to different depths, on the summits of which reefs have grown up to the surface. Again, these banks ascend from a second plateau, which lies at a still greater depth, this towering directly from the basin of the Indian ocean. As far as possible we sounded this plateau, running three lines between the two series of reefs, and joining across six of the channels between the separate banks. These showed that the plateau has a general depth of about 190 fathoms, increasing in the passages to about 240 fathoms. In the channel between the two Male atolls we carried the line out eastwards, getting 1030 fathoms within 2 miles south-east of Hulule reef. This is the sole sounding off the central part of the deep plateau which at all suggests its contour-lines, but there are a few other soundings north and south, which indicate that it is everywhere about the same. A comparison, too, with other similar, better-known banks in the ocean shows the strongest possible inherent probability that its rise is extremely rapid.

There are many gaps in the soundings, which ought to be filled up, but so far as they go, they indicate that the banks of the Maldives arise on a flat plateau, situated at a depth of about 190 fathoms. There is no evidence from which the origin of this plateau may be in any way deduced. It can scarcely have been formed as such either above or below the sea. That it is the remains of a former reef-bank is almost impossible, since there is in the soundings no trace of deeper water in the centre—in fact, of lagoon. Indeed, the depth gradually increases from the centre outwards in every passage that has been sounded, until presumably the more rapid outer drop is reached. The bottom deposits give no direct help. There was no considerable thickness of ooze of any sort, a few coarse coral or shell fragments alone being obtained;



MALDIVE ISLANDS.—SECTIONS.

the *valve* lead repeatedly came up empty, the *snapper* alone giving an occasional sample. The bottom, hence, must have been extremely hard, suggesting almost a current-swept ridge. Indeed, it is to current-action that we must look for an explanation of the origin of the plateau. It is quite unnecessary to repeat the evidence and views of Sir John Murray * and Admiral Sir W. Wharton † as to the action of marine currents in cutting down land. The depth, to which they act, alone requires consideration. Admiral Wharton instanced the remarkably steeper fall at 80 to 100 fathoms in the contours of land exposed to the great oceans as showing the depth to which material from the coasts can be moved. If this is the depth in this position, would it not be much greater

RAISED CORAL-LIMESTONE MASS, SHOWING UNDERMINING AND EROSION.

where there is only a peak, series of peaks, or bank exposed fully to the great oceanic as well as the tidal currents? Even with a rough direction-indicator—a compass with vane which could be thrown out of gear by a messenger—I was enabled to note the directions of the currents down to 130 fathoms off Minikoi and to 150 fathoms between the two Male banks. I further got some comparative results as to the rate of the current with a common river-meter down to 50 fathoms. It should be easy for any well-equipped ship to study their direction, rate, and depth anywhere in the ocean. My instruments were poor, and my results only indicate that my supposition that the great plateau of the Maldives was formed by the cutting down and levelling of land by the oceanic and tidal currents to its present depth, is not unreasonable. The land may have been the Himalayas of a great continental land joining Ceylon to Madagascar, or, as Sir John Murray

* *Proceedings of Royal Society, Edinburgh*, vol. x. p. 507, and subsequent papers.
† *Nature*, vol. 55, p. 390.

suggested to me, a series of volcanic erupted masses. What it may be is entirely a matter of theory, and a question to which the geological study of the Indian continent has so far yielded no clue.

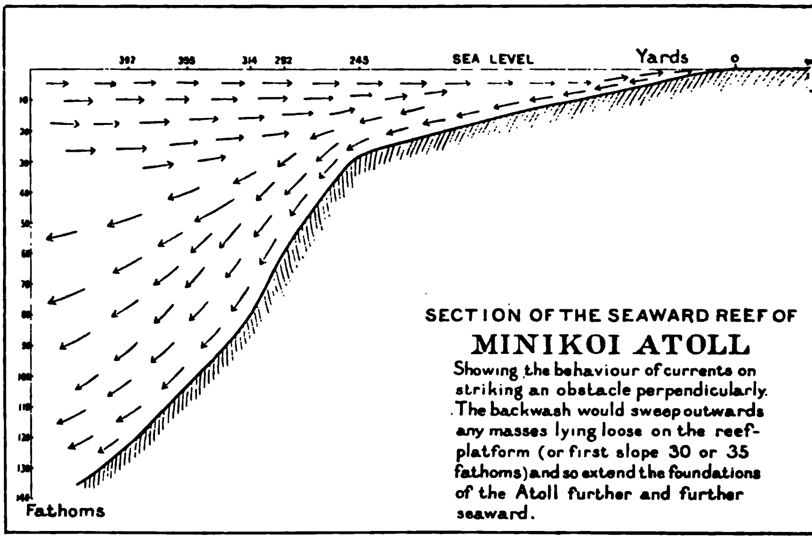
It may be contended, and perhaps truly, that the separate banks are the remains of some of the peaks; that Kolumadulu or Male perhaps were the sites of mountains, which were cut down 20, 40, or even 60 fathoms and then built up by the reef-organisms to their present level. This does not seem to me probable, on account of the great regularity

LAGOON BEACH, SHOWING WASHING AWAY OF THE LAND IN FALLEN COCONUTS AND OTHER TIMBER.

of the common plateau. Under such circumstances, its central part should have a much more definite basin-like form, with traces of the central valley. The channels between the banks would not necessarily but probably be shallower than the central part of the basin. There are further reasons in respect to the formation of the lagoons and their subsequent changes, which would make such a supposition appear to me highly improbable. Yet at the same time it is quite reasonable to suppose that the banks commenced to grow up before the plateau attained its present depth. The washing away would naturally be

slower with the deepening of any bank, but the upward growth of reefs at any points would tend by providing obstructions to accelerate it. The extremely hard bottom, found by our soundings, can only be explained on the view that the bank is still current-swept. The considerably greater depth in the channels as compared with the centre of the plateau must, I consider, be explained on the same view. There is no means of estimating this additional washing away since the banks commenced to grow up, but it may perhaps be safe to provisionally take the lesser depths found, about 160 fathoms, as the depth of our original plateau.

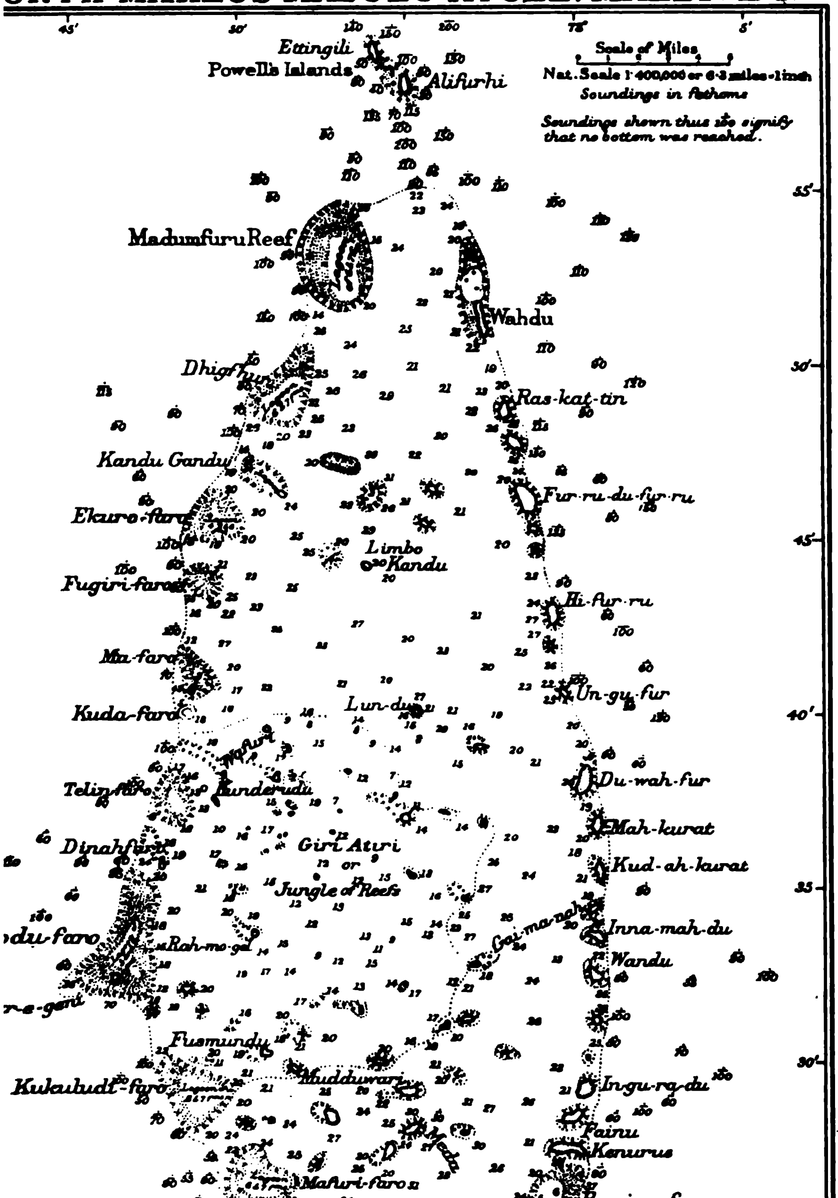
I conclude, then, that an almost flat plateau at a depth of 160 fathoms was at one time formed, and that on this the banks arose severally.



SECTION OF THE SEAWARD REEF OF
MINIKOI ATOLL
Showing the behaviour of currents on striking an obstacle perpendicularly. The backwash would sweep outwards any masses lying loose on the reef-platform (or first slope 30 or 35 fathoms) and so extend the foundations of the Atoll further and further seaward.

So far as sections have been run off atolls in the Pacific and Indian oceans, there is in all a striking uniformity in slope, a gradual fall to something under 50 fathoms, succeeded by a steeper drop to about 150 fathoms. The agreement in depth with our Maldive plateau suggests that this is the depth to which the currents have sufficient force to cut down the land and prevent the growth of reef-building organisms. Below this depth we have, I believe, the volcanic or inorganically formed basis of our banks. This was, of course, suggested in the first place by Sir John Murray, and in commenting on it Sir A. Geikie postulated that this depth "is probably nearly coincident with the lower limits of reef-builders." Neither, however, imagined depths approaching 150 fathoms, but with increase of knowledge the depth at which reef-builders may live has gradually been further and further increased. It has been pointed out that the reefs are formed

ORTH MAHLOS MADULU ATOLL. MALDIVE Is



very largely by calcareous algæ (nullipores), and that reef-corals feed mainly by their commensal algæ.* The limit in depth at which these may live is a physical question depending on the power of sunlight to penetrate sea-water. There are no absolute experiments which bear directly on this point, but the results of dredging point to a depth of 150 to 200 fathoms as the effective limit at which the nullipores can live. The reef-corals do not extend so deep, but other corals might well have been important contributory, or indeed the chief agencies in building up the several banks, as Mr. T. Y. Buchanan has shown.†

In reference to this same question, I may guard myself against a slight, a possible misconception. When I point to the change from the steep to the more gradual slope of the basal mass, I do not assume that the whole of the mountain below this is absolutely built up of inorganically formed rock. When the reef once reaches the surface, it spreads outwards on every side like the ever-growing fairy ring. The current sweeps back from the first slope, and drops any loose masses it may find over the wall outside. More and more of the bank or mountain reaches the limit of depth of the reef-builders, and these, assisted by sand and any masses from the reef above, which they may catch, build up, as it were, course after course, and so thicken our wall.

Returning from the theory of the formation of the banks to the actual changes taking place in respect to their reefs, attention may be called to a few which throw light on the question of atoll-formation. Each bank perhaps serves to illustrate best some particular point, but so far as possible I shall draw my illustrations from the north part of Mahlosmadulu. This bank is divided by two narrow channels of 125 and 110 fathoms into three parts. Each part is studded all over its surface with reefs, some with land. There are no definite circumscribing lines of reef, but the areas of the three banks are marked out by series of isolated patches. These on the east and south sides of the whole bank are small and usually crowned with land, while those on the west are ring-shaped—indeed, small atolls or *faro*, with relatively deep water in the centre and little or no land on their reefs.

The islands are formed either of rock or sand. The latter is the ordinary material which washes over the reef, piled up by the waves. It is formed largely of coral and nullipore fragments, with pelagic foraminifera, broken shells of Mollusca and Echinoderma, leaves of Halimeda and similar algæ, with small pieces of pumice and a certain quantity of drift organic material. The rock is formed of corals, nullipores, possibly *Polytrema*, and sand. Coral predominates, but is here and there overlaid by incrusting *Lithothamnion*; the sand merely fills in

* *Vide* "The Building of Atolls," by J. Stanley Gardiner, *Proceedings International Congress of Zoology, Cambridge*, p. 119 (1898).

† "On Oceanic Shoals discovered in the s.s. *Dacia* in October, 1883," *Proceedings of Royal Society, Edinburgh*, vol. xiii. p. 428 (1885).

the crevices and hollows. The surface of the rocky area is covered with loose coral masses, but when these are removed, a layer of solid coral-rock is reached, usually about the high-tide level.

The central islands of Mahlos are formed generally of sand, but those on the rim have definite rock and sand areas. Whatever part of the rim-island lies within 300 yards of the outer, the seaward edge of the reef, is of rock, and the rest of sand. There is nothing to show clearly whether the sand areas were built up entirely by the waves, or partially owe their origin to other causes; they certainly are increasing in extent, wherever the rock affords protection from the heaviest seas. The rock is everywhere between tide-marks washing away, partially by

EAST POINT OF MALE ISLAND. TO THE RIGHT IS SEEN THE ROCKY POINT OF THE LAND WITH THE WAVES BREAKING OFF IT, AND TO THE LEFT THE REEF-FLAT. IN THE FOREGROUND THE LINES OF RAISED LIMESTONE SHOW THE FORMER EXTENSION OF THE LAND.

solution and partially by the wear and tear of the waves, acting on it when already weakened by boring organisms. The reefs to seaward of the rim-islands are, for some distance from the land, studded with masses of the rock, which form pinnacles or negro-heads. The softer parts of the rock are naturally removed first, and the harder constituents, the corals, remain. The latter can commonly be seen to lie absolutely in the position in which they grew. They cannot live above the lower limit of the tide, and hence the rocky land must have been formed by some alteration in level of the original reefs in respect to the sea. A few pinnacles stand up for 10 feet above the reef-flat, which is at the lower limit of the tide, and some parts of the rocky area of the land are

3 or 4 feet higher. Allowing nothing for the denuding action of rain, which must have been far from inconsiderable, a change of level of 13 or 14 feet is proved. It is not a great change, but it is extremely important, as it seems to extend not only through the Maldives, but over the whole Pacific ocean as well. Indeed, most of the land of coral reefs in these regions is explicable only on such a change of level. No definite cause for this can be assigned. It is not, I think, to be found by postulating an actual elevation, but rather by studying the formation of the neighbouring land-masses in the past, which must by their attraction have profoundly affected the level of the ocean in their vicinity, together with the two polar and other more complex conditions.

My next point bears reference to the actual growth of the reefs. It is not, so far as I am aware, disputed that an atoll-reef in an area of stable equilibrium will grow outwards, *i.e.* seawards, on all sides. It cannot be doubted that this is what is really happening on all the rim reefs of Mahlos bank. Masses are growing up outside the edges of the reefs, to be joined to them by further growth. Hollows are filled in by fragments and sand, and are bridged over by nullipore growths. To some extent the same is taking place in the passages which lead into the interior of the same bank. Their narrowest points are towards the sea, and inside between the reef-patches they gradually widen out like corrals. This is the case on both the east and west sides of North Mahlos, and points to a tendency on behalf of the isolated reefs to consolidate into long, narrow, linear reefs. With limited time, hands, and means, and with only small-scale charts, it was impossible to sound the passages so as to get any comparative results with Moresby's survey. The existence, however, of ten definite shoal patches in the passages into Mahlos shows sufficiently well what is going on. By dredging, colonial corals, nullipores, and *Polytrema* were brought up in the passages alone, save in the immediate proximity of reefs. The discovery, too, of shoals in many apparently well-surveyed passages of other banks in the Maldives leaves little doubt but that there is an upward tendency of growth around the circumference of Mahlos bank as well.

The inner or lagoon side of the same rim reefs of Mahlos bears a striking contrast to the seaward. The consolidating action of nullipores may be practically neglected, the reef being formed mainly of corals. There is no definite reef-flat. The slope to within 5 fathoms of the general level of the whole bank is almost precipitous and devoid of sedentary forms of life. The lower 5 fathoms is more gentle, the bottom covered with dead coral masses, with an occasional living colony of *Dendrophyllia* and *Madrepora*. There is nothing to indicate the further broadening of the reefs by direct organic growth save in a few peculiarly open situations. There might conceivably be a broadening anywhere by the piling up of coral masses from the reef above

at the edge of the steep, but of this action we saw no traces. It is doubtful, in the first place, whether loose masses would rest at such an angle as found in the steep, and our dredgings over the whole group gave this view no support. The dead coral which was dredged was generally rotten from the action of sponges, algæ, polychaets, sipunculids, and other boring organisms. It was neither coated nor otherwise protected by organisms, and seemed, indeed, to be rapidly breaking down. These same characters were found on the lagoon sides of all the reefs which can be said to have a lagoon, of all the larger banks of the group, at the passages passing gradually into the seaward conditions. They are more marked in those banks such as Suvadiva, with more perfect rims. They are well defined in the maze

LINE OF RAISED ROCKS, WITH A FEW TREES GROWING ON THEM, TO THE SOUTH OF MUDDUWARI, NORTH MAHLOS ATOLL.

of reefs in the centre of North Mahlos; but are, however, somewhat obliterated off the east rim reefs, owing to the washing over of sand from the land, and off the west reefs are not so marked as in more perfect atolls. In Miladumadulu they are still less clear, and off some reefs are not found, the characters approaching those of the seaward sides. There is abundant evidence in pinnacles on the reefs, lines of sand-rock, fallen timber, and in the disappearance of islands charted by Moresby, that all land in the interior of North Mahlos is washing away. The reefs where conditions such as shown above exist must, I consider, be going as well, the final result, together with the joining up of the rim reefs, being a perfect atoll.

Together with the washing away of the land, fresh conditions tend to be found on its reefs. The washing away of the latter is an extremely slow process, and does not commence to any important extent until the whole bank has begun to assume the atoll-form. Even then, should there be a relatively small circulation of water over the reefs of the atoll, as, for instance, in Addu, there may be, on the contrary, no loss in the lagoon reefs, and they may rather materially assist in filling up the lagoon. On the other hand, where the bank is open, the conditions

may remain favourable for the reef-builders, and the reefs may continue to grow outwards in a somewhat similar manner to the seaward reefs of the rim. The washing away of the land is, in any case, a much more rapid process than that of the reef. Limbo-Kandu shows the earliest stage. It was at one time presumably a reef on the Mahlos bank, with its summit awash, hollowed out to a depth of, at least, 4 feet in the centre. Its level, by the general change through the Maldives, was raised at least 13 or 14 feet. The walls of the island would then have presented a precipitous slope to about 20 fathoms. The land began to be washed away, with the result that a flat 30 to 40 yards broad was formed round the island. The reef too, doubtless by slight outward growth, assisted in forming this flat. This is the condition of the reef now, and the flat off most sides is well marked. The erosion continues, and in the next stage a sandy channel is found to have been cleared out within the flat to a depth of 3 or 4 feet, as at Meda, Cunderudu, Mudduwari, and off many of the east rim-islands. The washing away would not, perhaps, take place evenly on all sides, and the reef might be further distant in one place than another. The further the reef from the land the greater the hollowing out, with the result that the channel may be termed a lagoon. This is seen in many of the reefs, but it cannot usually be traced to be directly due to this cause. The original island of Fusmundu, however, may be clearly marked off over the greater part of its reef. The western three-quarters of that island have been completely washed away, such land as remains lying on the east rim of the reef. The former channel has become a small lagoon with 2 or 3 fathoms of water.

Almost in the same stage is the state found in Wahdu, Kandu-Gandu, and Wafaro, where islands exist on each end of the reefs, the central parts being hollowed out to form lagoons. In such cases, one or both of the ends of the original islands being formed of rock, its or their erosion would be much less rapid. In most of the west reefs the conditions have reached a further step, the lagoons being hollowed out to a greater depth, and the original islands being lost. They are, hence, definite atoll-banks. A few have pinnacles of rock showing the position of the former land-masses. Others have sandy islands, some of which were, perchance, parts of the original elevated land-masses, but give no decisive evidence as to their formation. Most have no trace left of land, but the conditions which lead to the formation of an atoll by the hollowing out of the reef are the same whether that reef was originally crowned with land or not. The size depends on the outward growth of the reef, the hollowing out being proportional to this. The conditions on the west of Mahlos, towards the interior of the bank, cannot in the past have been far different to those on the rim of any bank freely exposed to the sea, and must have been always much more

favourable than on the east, where the bank is protected by Miladumadulu and Fadifolu banks. As the reefs increased in size, closing in the bank, the conditions only would approach those in the interior of a definite atoll; in effect the erosion of the reefs, as sketched on Mahlos bank at the present day, would only begin to be found.

The comparison of the west atollons or *faro* of north Mahlos, as found by me, with Moresby's chart of 1836 yielded results of considerable interest. It showed that Dinafaro and Wafaro have now definite basins, while the lagoons of all the rest have increased both in size and depth. The original charts of Moresby are of small scale, and it is

LAGOON BEACH OF AN ISLAND, WITH A FALLEN COCONUT, SHOWING THE EXPOSED ROOTS OF THE TREES AND EROSION OF THE LAND.

difficult to appreciate the value of the comparison. The old survey bears internal evidence of its having been a most careful one, and I consider that the differences found in 1836 and 1899 are to a very large extent real. Even if this be so only to a limited degree, this comparison alone yields absolute examples and proof of one mode of formation of atolls from small surface reefs, *i.e.* by the outward growth of such reefs and the solution of their central parts.

Bodu Faro exemplifies one more point of which I have found many other undoubted examples, though not in north Mahlos. The merest glance at Moresby's chart shows that the reefs of these western atollons are broader towards the sea and narrower towards the centre of the bank. This at the present day is even more strikingly the case than shown by Moresby; but, of course, the difficulty of comparison with a small-scale chart is in this further intensified. However, Bodu Faro

gives definite evidence. Its depth now is 13 fathoms instead of 7 or 8 fathoms. Moresby's survey has three soundings—18, 15, and 18 fathoms—close to the east reef, which is represented of considerable breadth. The depth of the lagoon being given, one of the surveyors must have entered across the reef; but even the veriest tyro, making the above soundings, could see the character of the reef. It was presumably, then, in 1836 a broad surface reef, while in 1899 I found it to be opposite the above soundings, covered with 2 to 6 fathoms of water, and quite narrow. There is evidence here of the lagoon part of the reef washing away, the result being, together with the growing together of the rim reefs, to form a long narrow linear circumscribing reef.

I think that from the above alone it will be conceded that the expedition has justified its existence. It has shown that the banks of the Maldives arise on a common plateau at a depth of about 190 fathoms. The land has been undoubtedly, by some means or other, raised above the sea, and is now everywhere on the larger banks being washed away. The atoll-reefs are growing outwards on all sides, while their lagoons are increasing in area, and probably also in depth. The atolls owe their existence to the fusion of reefs lying on the circumferences of banks, together with the washing away of the reefs in the interiors of the same banks as their circumscribing reefs became more perfect. In general, the results of the expedition are in striking agreement with the conclusions drawn by Sir John Murray as to the formation of atoll reefs; but I should hesitate to apply these views to all coral-reef areas in the present state of our knowledge, to the exclusion of the subsidence or any other hypothesis.

Before the reading of the paper, the CHAIRMAN, Colonel Sir T. H. HOLDICH, Vice-President, said: In the absence of the President, I have the pleasure to tell you that despatches have lately been received from Captain Scott of the *Discovery*. These despatches are in every way most satisfactory, and the gist of them, together with further information about the expedition, will be given at the second meeting in February. I will not detain you longer, and I will now ask Mr. Stanley Gardiner to read his paper.

After the reading of the paper, the following discussion took place:—

Admiral Sir W. J. L. WHARTON: An intricate and complex subject like the formation of reefs, which has formed a subject of discussion for so many years, can only be solved, if it ever can be solved, by very hard and patient work. And we may congratulate ourselves, and I hope I may be allowed to congratulate Mr. Gardiner, on the admirable way in which the author has set himself to this task. He has devoted a great deal of time, he has risked his health, and done a great deal to furnish material not only for this night's discussion, but for many nights' discussion. He has set before us in a most admirable manner the conditions in the Maldives, and he has given us his own ideas on the way in which they were formed. I do not suppose any of us will accept exactly his propositions; it is too vast a subject to be summarized, but he is quite right to have attempted to summarize it, because

it forms a very good subject of discussion. There is one point I think I ought to mention. I do not quite think that Mr. Gardiner can rely so implicitly as he does upon the exact accuracy of the shape of these little atollons in the Maldives as they were mapped by Captain Moresby. If you come to think of it, this long line of islands extends for nearly 500 miles in a double line and over considerable width, and was mapped during three seasons in a small sailing vessel, and it is quite impossible—I know what the system of surveying of that day was—is quite impossible that the reefs could have been more than very, very roughly sketched; and while not at all disputing the evidence that he has brought forward that some of the reefs have changed in their width and in their depth, too much weight must not be put upon that unless the evidence can be very much accumulated. I should very much doubt whether the boats went into those entrances at all. In a great many cases it is noted down in the original surveys, "depth given by the natives," "depth reported," and so on. This has been left out in the published chart to simplify matters. But when we hear that the depth is 5 or 6 fathoms now, and it was only 3 or 4 sixty years ago, we must take it with a little suspicion. I should like to know, and Mr. Gardiner perhaps can tell us presently, whether any of the atollons are smaller. I understood him to say that the majority of the lagoons were widening out, and I should like to know whether the lecturer noticed any that were filling up. I must confess it is a little startling to me to find the changes that Mr. Gardiner supposes to have taken place, because they are very vast; they are very large indeed. The changes in the depths of some of the lagoons there amount to as much as 30 or 40 feet. I think Mr. Gardiner mentioned as much as 40 or 50 feet in sixty years. That is an enormous change. I refer to the southern islands, where he showed us the lagoons have been filled up so much; and then in the others in some cases there has been solution. I should also like to ask Mr. Gardiner whether in any case there are any islands now on the reefs where in Captain Moresby's chart there are no islands marked, so as to know whether the evidence is all one way. There is another point Mr. Gardiner, in what he gave us, has not mentioned; it is referred to in the written paper, but he did not mention about the formation of the atollons, and it is a very remarkable thing about the formation of these small Faros that they are not found anywhere else in the world, except on the western side of the Maldives and a few cases in the Louisade archipelago. It is a most interesting subject for consideration. Perhaps Sir John Murray will be able to give us some ideas on that presently. I do not know that I shall keep the audience any longer with my remarks. I only wish again to congratulate Mr. Gardiner on the vast amount of information he has collected.

Sir JOHN MURRAY: With the general summary with which the lecturer concluded his address, I have every reason personally to be satisfied. I entirely agree with him in his views as to how the present condition of affairs have been brought about, and I certainly must congratulate the lecturer upon the excellent way in which he has placed his results before this audience, and the still more excellent work he has done in the field. I do not think anything could more tend to place this country in the front rank of scientific investigation than the sending out of such men as Mr. Gardiner and his colleagues, men who have been trained in the work of scientific investigation, into the open field to do the work of surveying. He has done it well, and I am sure we are all glad to see him back again in apparently such good health. I still think that the probabilities are altogether in favour of that base being of volcanic origin. At the present moment Mr. Alexander Agassiz is working in this group with certain apparatus which will enable him to work at greater depth than Mr. Gardiner. If he collects specimens of manganese in any

form on the steep slopes of these islands, then I should say that is strong presumptive evidence that the foundations are composed of volcanic material. If, however, he should meet with some quartz glauconite and other like minerals, then I shall say the evidence will be entirely in favour of the view Mr. Gardiner has put forth. With respect to the manner in which these reefs grow up, I think Mr. Gardiner's theory by far the most plausible according to the present state of our knowledge, and with almost all he has said I cordially agree.

Lord STANMORE: My connection with the Maldives has been a political, not a scientific one, and therefore one which is far less interesting and far less important in this hall. But yet, as having had to deal with and settle various Maldivian revolutions, I may perhaps be allowed to congratulate Mr. Gardiner upon the manifest thoroughness of the work which he has done, and of the value of the results, and to express my own deep regret that it was not in the time when I could have had the opportunity of extending to him any facilities that it was in my power to afford him or to help him on his way in his work. I am not a scientific man; all that I can claim is that occasionally I look about me, and I have looked about me at coral islands in many parts of the world, and though it is not for me to express any opinion, and I shall not express any opinion as to their formation, this much I think I may say, and I think Mr. Gardiner will not dissent from it—that without making any theories on the subject, it is necessary to take into account the very various physical conditions of the different localities in which these coral formations are to be found. I mean that in some places where you have extensive coral formation you have the most active and violent volcanic agency still in force, still active; in others, that action if it ever existed is absolutely dead, and you cannot expect, I think, to find exactly the same state of things where you have two such totally different conditions of physical existence. I dare say Sir John Murray knows quite well, but I remember being very much struck on seeing in one of the remote islands of the Seychelles, Frigate island, a manifest coral reef forming a complete lagoon on the top of an igneous rock some 200 feet above the level of the sea.

Sir JOHN MURRAY: Quite common.

Lord STANMORE: But my object in rising was not to give a lecture on a subject on which I am quite incompetent to give one, but to express my sense of the value of Mr. Gardiner's work, and my own hearty appreciation of it.

Dr. W. T. BLANFORD: I can only add my meed to that of those who have spoken of the admirable piece of work that Mr. Gardiner has effected. For a great number of years, all those who take any interest in oceanography and in coral islands have been most anxious to obtain further details about the Maldives. They are in many respects a singularly interesting group of atolls, and especially in one point on which considerable stress has been laid, and that is the great depth of the lagoons within the atolls. I believe the case is almost unprecedented of lagoons being 40 or 50 fathoms in depth in other coral islands. It is possible that we should do better, before expressing any opinion as to the results, to wait until these are published in full detail. We are not sufficiently acquainted with what has been done by Mr. Gardiner from simply hearing the short account that he has given us this evening to express a very definite opinion. But still there are one or two points in which I cannot quite agree with the conclusions formed, and I think it is only right I should mention them. In the first place, the theory for which I think Sir John Murray is responsible, of the origin of lagoons by solution, has always appeared to me one of extreme difficulty. The most important evidence in favour of it which has been brought forward by Mr. Gardiner has been shown by Sir William Wharton to be open to some little doubt, and I would specially point out that the evidence is contradictory, because if some of the atolls in the northern

islands have increased in depth, the atoll in the most southern island appears to have diminished. But that is not the only point about this atoll. I do not know whether it will be within the recollection of those who saw the representation of Addu atoll upon the screen, that the inlets through which the water enters are all very much shallower than the lagoon. Now I venture to suggest that, if the depth of the lagoon is due to solution, the deepest part ought to be the inlets.

Sir JOHN MURRAY: Not at all.

Dr. BLANFORD: Surely water in rapid motion is more effective than water comparatively at rest?

Sir JOHN MURRAY: Not at all; an inch of water will only take up the same amount of lime.

Dr. BLANFORD: In general, water dissolves more when it is in motion.

Sir JOHN MURRAY: A cubic inch of water will take up the same amount of lime whether it is at rest or whether it is in motion.

Dr. BLANFORD: At any rate, a greater quantity of water passes over the surface. I must say there appears to me to be a difficulty in this way. It is certainly a wonderful thing if water has dissolved the rock to 30, 40, or even 50 fathoms in depth. Then, another part of that theory of the formation of the atolls which was brought forward by Mr. Gardiner also appears to me to be in need of further evidence. Let the rock forming the bank on which the Maldives stand be what you please—it may be volcanic, or it may be granitic or even sedimentary—I do not think we are justified in believing that any oceanic current can cut down a bank to a depth of 200 fathoms. Formerly we were under the impression that at the outside 8 or 10 fathoms was the depth to which water would cut down rock; but I believe it has been shown that waves are effective to a greater depth. Some effect may be produced to a depth of 30 or 40 fathoms, but beyond that it is very difficult to understand how erosion takes place. Erosion is produced by the action of solid particles moved by the water. I would therefore suggest that, instead of the bank having been actually formed at a depth of 200 fathoms below the sea, it was probably formed very much nearer the surface, and that it has sunk, producing precisely the conditions on which Darwin's theory of the formation of coral islands proceeds. Then I think it is also more than one is fairly justified in doing to suppose that the deep-sea corals are capable of building up massive reefs. The great reef-building corals are only known to exist near the surface. These are points of difficulty. On the other hand, I must say it is exceedingly satisfactory to hear that Mr. Gardiner is inclined to agree with those who have paid particular attention to the geology of India, in believing that there was at one time land union between India and South Africa. One point I might mention is that the only high islands that occur in connection with the great line of scattered atolls which appear to unite India and Africa are the Seychelles, which are formed of gneissic rock. There is one more point I should like to call attention to—the very interesting photographs of the natives of the Maldives that were shown to us at the commencement of the lecture. Some of the faces appear to me to have a considerable resemblance, so far as one can judge from the physiognomy, to some of the aboriginal hill tribes of India. It may be remembered that Prof. Huxley, I think, pointed out the extraordinary similarity between some of these people and the aborigines in Australia. It is by no means impossible that the same race may be found amongst the primitive inhabitants of the Maldives. I can only say, in conclusion, that I listened with a great deal of pleasure to the most instructive lecture Mr. Gardiner has given us.

Mr. GARDINER: I should like to thank the various speakers for the very kind words in which they have referred to my paper. I would in particular express my

gratitude to the first two speakers, Admiral Wharton and Sir John Murray, for their great kindness to me and for the practical assistance and advice that they gave me in drawing up the route of this expedition. I would also like to express my indebtedness to Sir Edward Walker for his kindness to me when he was acting-governor of Ceylon. I do not think that there are many points that it is necessary for me to refer to. With regard to Admiral Wharton's question of the reliance placed on Moresby's chart, I showed the changes compared with Moresby's charts, but I do not personally believe in such very great changes as one saw there. I believe, however, there has been change. I consider that it is impossible for Moresby to have made such great errors as would be required, were there not really some changes in the direction of the clearing out of the lagoons of the faro to the west of Mahlos atoll. There is the same change right throughout the lagoons. I have not found a single lagoon of any faro that seems to be filling up. I quite agree with Dr. Blanford in saying that the full account of the group is really required before discussing the subject of this paper. I hope that it will be published shortly. With regard to Dr. Blanford's reference to the solution in lagoons, Dr. Blanford has, I believe, asked one particular question which also bears reference to his remarks to-night. Why it is that some of the reefs wash away and some reefs do not? Why it is that the outer reefs of the atolls are not dissolved, and that the reefs in the lagoons are dissolved? I might point out to Dr. Blanford that where the water is in motion the basal reef is protected by growing organisms. According to my observation, solution cannot take place through these growing organisms, and it is for that reason that I consider that the passages of lagoons are not being deepened, that there is no solution practically going on in the passages into the lagoon banks, and that there is no noticeable solvent action on the seaward sides of the encircling reefs of atolls.

Dr. Blanford: My remark applied to the inlets.

Mr. Gardiner: The bottom of any passage is covered with living organisms, so that it would apply to that equally with the outer reefs. Where the water is in motion the organisms dwell. With reference to the effect of currents, we managed to take the direction of the great monsoon currents by means of an indicator, a compass which could be thrown out of gear by means of a messenger. We managed with this to record the direction of currents down to 150 fathoms. The surface current was in places travelling in one direction, the under currents were running in the opposite direction, yet time after time the compass came up showing always the same direction at any particular depth. It seems, then, with a rough direction-indicator one can measure down to 150 fathoms, and I think the currents may well extend to a much greater depth. I should point out, too, that in Mr. Buchanan's observations near the Canary islands, the effect of the currents was noticeable down to 1200 feet. With regard to the building up of reefs, I would also refer to Mr. Buchanan's account of numerous shoal-patches in the Atlantic ocean. Some of these are within 50 fathoms of the surface, and Mr. Buchanan laid particular stress on the fact that they must have been formed entirely by means of the deep-sea corals. Now, in reference to these same corals, I quite agree with Sir John Murray that on the face of a reef is the most vigorous coral growth; but so far as corals are concerned, most, practically all those which may be called reef-builders, I believe obtain their food by means of their algæ, and that on the face of the reef there is the more vigorous growth because the motion of the water brings fresh carbonic acid gas to them continually. Of course this is a question which is entirely *sub judice*, and I have not made enough observations to speak definitely on it; I only say what my belief is, and that my experience differs rather from his. I may refer for an instant to the natives of the group. What

race they roughly belong to seems to be a very mixed question. I know nothing about their measurements myself, but I am informed that they seem to differ practically from any race at all that Mr. Duckworth has had anything to do with. They are a very intelligent people, an extremely quiet people, and I may mention that there is one name which is particularly well known throughout the Maldives—that of the third speaker who spoke to-night, Lord Stanmore, who was then known as Sir Arthur Gordon. They continually asked me about him. In conclusion, I would thank you all, Mr. President, and ladies and gentlemen, for your kindness to me.

The CHAIRMAN: I fear that no words of mine could add much to the interest of the discussion this evening. Mr. Gardiner has taken us into regions which are probably as unfamiliar to most of you as they are to me, but you will agree that he has given us a most interesting and graphic description, not only of the conditions of life in those islands as they are at present, but he has given us some short insight also into the life-history of the islands themselves, their construction, and their disappearance. I am sure you will wish me to convey for you the hearty thanks of the meeting to Mr. Gardiner for his paper.

THE IMPORTANCE OF GEOGRAPHY IN EDUCATION.*

By the Right Hon. JAMES BRYCE, M.P.

WHEN my friend the chairman asked me to give you an address, I felt some diffidence in doing so, because I know that members of the Geographical Association are themselves persons for the most part possessing a practical acquaintance with the subject much greater than I could lay claim to, and I always feel that it is dangerous for an amateur to give an address to specialists. I consented, however, chiefly because the occasion gave me an opportunity of expressing the very warm interest which I feel in the work of your association, and my hearty sympathy with it. Nothing has been more wanted for a long time than that an association of this kind should exist for pressing upon the public a knowledge of what its real interests in geographical teaching are, and for that reason I very gladly consented to say what I had to say to you. I cannot hope to say anything novel to those who are familiar with the subject, but I may perhaps attempt to lay before you a few considerations which bear upon its wider aspects, and which are chiefly suggested by observations that have occurred to me in the course of travel in different parts of the world.

The place of geography in education may be considered under three aspects, and I will distinguish those three aspects by the shortest phrases I can find. Geography in one aspect or sense is the gateway to the physical sciences; in the second aspect it is the key to history; and in the third it is the basis of commerce. These three aspects in

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which it may be regarded correspond to the different parts of school, college, and university work, and they have to be carried out and conducted to some considerable extent by a different part of the educational staff of a school or college or university, and yet each of the three has very important relations to each of the others. This is especially true with regard to the first two, and yet the third is also in intimate relations to the two former. He who wishes to understand geography in any one of these three aspects ought to know something about it in the other two aspects; and he will find what he knows about it in any one of the aspects, of which the first is after all the most fundamental, will help him to comprehend and to apply his knowledge in the other two.

Let me begin with geography as what I have called the gateway of science. We may say that man touches nature, the external world of nature, in two points. First of all he touches it through the constitution of his own physical body. As possessing a body, he is himself part of nature, and he comes into relations with it through that body. The study of these relations belong to the sciences which we call physiology and biology. Then he also touches it in another way. He touches it through the external world, the phenomena of which he learns through his senses and in which he is placed to do his work. Geography may be described as being the general science of the Earth, perhaps I ought to say, of the Earth as a part of and affected by other parts of the material universe, but in the first instance, and for our more immediate purpose, of the Earth which we inhabit. Geography is the science which takes for its province the describing to us everything that relates to the Earth.

All branches of knowledge which have anything to tell us about the Earth more or less hinge into or are connected with geography, or you may, if you like, say they diverge from it as specialized departments of that general knowledge which it presents in its connection with the whole. For instance, geography takes account of the solid crust of the Earth. The solid crust of the Earth is the special subject of three sciences, geology, mineralogy, and palæontology, which therefore diverge from geography as being specialized branches of the science which it presents in a general way. Then you have a second divergent branch in meteorology and oceanology, dealing with the phenomena of the air and vapour and the closely cognate phenomena of the great masses of condensed vapour which exist on the surface of the Earth in the form of oceans. A third branch is that represented by the sciences of botany and zoology, describing the living creatures which find their home and their sustenance on the Earth. A fourth, a little more remote, consists of the sciences of physics and chemistry, which again deal with the constituents of the globe and of the forces which move them; the forces which you see in operation on the Earth belong to the science of physics,

and the study of the constituent elements of the Earth, the methods by which they are analyzed, and the combinations which they form belong to the science of chemistry. Even astronomy, although it carries us beyond the limits of our terrestrial globe, is really closely connected with the science of the Earth inasmuch as many terrestrial phenomena are sensibly affected by the phenomena which lie beyond the globe, and cannot be understood without a comprehension of astronomy.

The whole of this great group of physical sciences, each of them re-divided and specialized into numerous branches and departments, springs from geography as the centre of the group. Physical geography in particular shows the relation which each of these branches of science bears to the others, and the way in which all taken together have an influence upon the life and development of man. One may figure the thing by saying that geography is a sort of great central hall, from which there open out numerous doors leading into apartments, each of these being dedicated to some particular one of the sciences which are connected with the Earth and its phenomena. All the apartments find their meeting-point, their point of convergence, the place through which the student must pass from the one to the other, in the science of geography which stands in relation to them all alike (or almost alike). Therefore in this sense you may say that geography constitutes the approach to all the physical sciences. It is the science which brings them all into correlation with one another; it is the science through which you can best observe the action of each of them upon the life of man. Thus it holds a highly significant place in education. Students who are going to devote their attention mainly to the physical sciences find geography a starting-point; it indicates the relations of the sciences to one another, for all are connected with the external nature in the midst of which we stand.

Students who are not going to devote their attention to the natural sciences, but to what are called the human subjects—literature, history, philology, economics, and so forth—again find in geography the point in which these subjects have their contact with the physical sciences. If such students are given at the starting of their career a due comprehension of the numerous bearings and relations which geography has to all the other sciences that deal with physical phenomena, they are better able to specialize in those special human branches of study which they intend to pursue, having gathered the relation which they all, through geography, bear to physical science.

This is the first point in which I venture to think you may claim for your science an exceedingly important part in the general scheme of education. It gives the student a proper conception of the relation of the sciences of nature to the sciences of man, and it shows how the different sciences of nature are related to one another.

Further, geography, and more particularly physical geography, upon

its practical side, becomes of the greatest value as a training in the art of observation. Physical geography, like other kinds of geography, used to be taught mainly out of books, and the pupil was allowed to have very slight contact with facts which he can see for himself. Happily all that has been changed, and I am glad to know that now in this country, as has for some time past been the case in Germany, it is thoroughly realized by all progressive teachers that geography must be made as much as possible an experimental science—experimental in this sense, that the pupils' minds must be brought into contact with facts, and not words, that they must be taught to connect what they read and what they hear from their teachers with the actual facts they are trained to observe for themselves. All competent teachers of geography have now begun to feel that they ought to start out by giving the scholar a direct personal knowledge, and not a mere book knowledge, of the meaning of geographical terms and the elementary data of physical geography; that he ought to be taken round the place in which he lives; that he ought to be shown hills, or mountains, if he is fortunate enough to have mountains in his neighbourhood, and notice the rocks they are made of; that he ought to be taught to observe the course of rivers and brooks; that he ought to be led to study the inclinations of hills and the structure and features of an undulating country, or of plateaus, or of riverine plains; that he ought to be taught to observe the trees and the vegetation generally which appertain to particular kinds of soil, or to particular exposures; and to keep his eyes open and his memory alert to watch the winds and the rainfall, and to acquire a knowledge of the climate of the region in which he lives. All these things, about which he reads in his text-books of physical geography, ought to be made real and vital and full of meaning to him, by being connected with the actual facts, which he can note and remember when they are shown him, but which he probably will not notice unless they are pointed out to him. He lives among them, but he may never observe them (unless he is an exceptional boy) until his attention is called to them. Physical geography, communicated in that way by an active-minded and intelligent teacher, becomes one of the best possible of trainings in the art of observation, an art which might appear easy and natural, but which in reality requires a good deal of training, because no one knows, until some incident calls his attention to it, how many of the phenomena among which he moves he has failed to observe.

Thirdly, from observation the study of geography passes into the stage of reflection and combination, that is to say, these phenomena which have been made real to the pupil by his being taught to observe them, have to be suggested to him as subjects for inquiry and brought into a casual relation with one another in order that he may ask himself, What has been the source of these facts I see in external nature, and how

are they connected with one another? He must be taught, whenever he is shown a fact in physical geography, to inquire into the cause, and whenever there are two facts, to ask what relation, if any, there is between them. What connection, for instance, is there between the inclination of the hills, whether gentle or steep, in a mountainous district and the character of the rocks and amount of rainfall in that district? What connection is there between the growth of trees and the rainfall and the prevalent winds? In that way physical geography will teach the pupil to acquire the habit of looking at a region as a whole, so that when there is any district which he has got to know by his own observation, he will begin to reflect and seek to discover what have been the physical causes which have gone to make this district what it is, and what relation exists between those various causes.

It is extraordinary how little most of us will observe of these matters if we are left to ourselves. Ask yourselves how many people among your acquaintance there are who have any intelligent knowledge of the weather, that is to say, who are in the habit of observing the direction from which winds come, and the phenomena of the sky which indicate fair weather or dull weather or rain respectively? You will find, I think, they are extremely few. It is a rare thing to meet even a man living in the country who has made an intelligent study of the weather and who constantly observes the winds, who knows from what kind of wind and from what aspects of the sky certain weather may or may not be expected. Of course we all know that the predictions of the best weather prophets, even aided by barometers and reports from outlying signal stations, are uncertain. But, at the same time, there is a great difference between the man who can make a tolerable forecast of what sort of weather may be looked for on an afternoon fixed for a picnic, and the man who has no data at all for an opinion, but thinks, as so many people do, that it is going to be fine at 3 p.m., because the sun is shining at 9 o'clock in the morning. In the same way, it is odd how very few people there are who notice the vegetation of the district in which they dwell. One is often surprised to find how few persons among those who are in a general way observant and intelligent, have noticed that particular trees and particular plants and flowers grow upon particular kinds of soil, or under particular physical conditions. If you were to ask, for instance, one of your ordinary intelligent friends who live in the country if he could tell what plants are characteristic ot chalk soils, or what kind of soil it is that any particular tree—let us say a fir or a beech—prefers, you would be surprised to find how few there are who could give you an intelligent and correct answer to such a question. Yet observation of this kind does not require any special botanical knowledge. There are persons who do not possess that special botanical knowledge, but could give those answers, but they are comparatively few. That is a third advantage, which I claim for the

study of geography as a gateway to science, that it may be made an admirable training, not only in observation, but also in reflection upon the phenomena lying all round us in external nature which we know from an observation that is within most people's reach.

Fourthly, the study of geography in this way adds immeasurably to the pleasure of travel. We all of us enjoy in increasing measure at the present time opportunities of travel by land and sea, and, for one person who crossed the Atlantic from the continent of Europe to the continent of America fifty years ago, I suppose there are at least twenty or thirty who cross now, while for one person who crossed the channel to France fifty years ago, there are a hundred now. How few people use adequately the opportunities for the observation of physical phenomena, or indeed for observation of any kind which travel gives, or who possess the amount of knowledge required to enable them to observe properly and to get the full enjoyment which travel is capable of yielding. There is no greater pleasure to be derived from travel than that of learning something about the country one is visiting. You cannot properly understand a country unless you have a knowledge of the fundamental facts of its physical geography, and have formed the habit of observing them. Without this, you cannot form a true conception of a country as a whole. Sometimes I have fancied it would be worth while to try and provide at one of our universities some systematic instruction in the kinds of knowledge and skill in observation which come chiefly into play in travel. There was a book written some thirty or forty years ago by a distinguished friend of yours and mine, Mr. Chairman, I mean Francis Galton, called 'The Art of Travel in Wild Countries,' which describes a great number of devices which the traveller will find useful in dealing with savage men and overcoming difficulties of wild nature. There is also another and very useful book of a similar kind called 'Hints to Travellers,' which has appeared since and gone through several editions. But perhaps there is still room for a book more comprehensive than either of these, and less scientific than the latter, more on the level of the unscientific mind, taking in some matters which do not belong to physical science at all. Such a book might suggest to travellers or tourists how to observe the relation of the rocks to the scenery, what the relation of the rocks is to the vegetation, what the relation of the climate to the vegetation, and how to estimate the productive capacity of a country, how to learn something about its races, about its antiquities, about its economic conditions, and about its languages or dialects. When one takes a long ocean voyage, one is surprised to find how small a number of persons there are on board who know anything of trade winds or monsoons or ocean currents, other than the now familiar, yet often not very well understood, Gulf Stream. Yet how much such a knowledge adds to the pleasure of travel. Such a book might be elementary enough to be fit for persons

possessing no special mastery either of science or of history. It would not replace either of the books I have referred to, but it might be useful to a somewhat wider public.

I now come to the second of the three aspects of geographical science—to geography regarded as the key to history. The conception of that relation has now become so familiar an idea that it is not necessary to go into it in any detail. Everybody has come to realize the important part which physical environment plays in the development of mankind, not only of mankind as a whole, but of every particular race of mankind, of every nation, and of every state. You have books like the new 'Universal History,' by Dr. Helmolt, which devote themselves to treating history from this point of view, and showing how it may be regarded as being the outcome of the physical environment in which man as a whole, and the different races and communities of man, have found themselves placed. This way of looking at history has only recently become common, and the fact is remarkable when one considers that the influence of nature upon man must have been present to the minds of reflective men from remote times. One finds isolated remarks on the subject even in the ancient philosophers and historians, so it is a little surprising that it is only quite recently, to the best of my recollection, that historians have begun to treat the physical phenomena of a country seriously and systematically as a very important element in the development of that country. Now, speaking from recollection, I think that Gibbon, for instance, makes few and scanty references to the physical phenomena of the regions over which his splendid survey of the passage from the Old World to the New led him. If one takes a still more brilliant ornament of the eighteenth century, Montesquieu, one of the most fertile and ingenious minds that ever approached historical inquiries, even he makes comparatively slight use of the relations of nature to man. You will, of course, in these and other great writers, find occasional remarks which show that the relation was not absent from their minds, but they do not seem to have grasped it as a whole or presented it with anything like the completeness with which a modern philosopher or historian would think it necessary, to explain the influence on man of his physical environment. One younger contemporary of Gibbon occurs to me who had ideas on the subject. I mean the traveller, Volney. In his book about America, which he visited shortly after the revolutionary war, he has made several rather striking remarks, which show that ideas of this kind were beginning to make their way. No doubt there are many other thinkers in whose works you will find indications of this way of looking at history; but it has been reserved for our own time to realize the extreme importance which environment possesses as an historical factor. And yet, after all, there was Herodotus. Herodotus, more than twenty-three centuries ago, was equally an historian and a geographer, although he did not bring the

two things into regular scientific connection, but any one can see that he was equally interested in both, and he was just as anxious to describe the physical conditions of the country as to give an account of its history and people.

We are now all agreed that geography is the foundation of history, and that the historian must know geography. It is perhaps not equally necessary that the geographer should know history. At the same time a geographer may gain a great deal by knowing something of history, and some branches of his subject will remain incomplete unless he possesses that knowledge. Without pursuing the subject into detail, it may serve to illustrate the proposition that geography is the key to history if I mention some branches of history upon which geography pours a direct and illuminating light. One of these, for instance, is ethnography. The whole study of the races of mankind and their connections with one another, and their mingling and blending with one another, and their passage from one part of the Earth's surface to another, evidently depends upon a knowledge of geography, and in particular of physical geography, because it is these physical conditions that have influenced the movements and blendings. So linguistic history, which is almost a branch of ethnography, is another subject on which the geographer can throw light. Or take the case of military history, itself a branch of political history, and consider how much physical geography has to tell the student of wars and campaigns about the importance of lines of communication, the significance of mountain ranges and rivers, the places available for fortification, whether by seas or rivers, or on hills. You will see at once that a knowledge of the physical geography of a country is essential to the man who studies military history in a scientific spirit. Then if you come to that large branch of history for which we have no satisfactory English name, it is what the Germans call Kulturgeschichte, the history of the social and economical progress of man, the history of the kind of culture which expresses itself in social life and artistic life, and the development of letters and learning and science—that branch again is, of course, intimately connected on many sides with the physical environments of the countries in which a civilization has been developed. You may find in such a book, for instance, as Mr. Payne's recently published 'History of the New World called America,' how the whole history of the aboriginal American peoples, and especially of those who early attained to a certain measure of civilization, can be treated most profitably in connection with the physical conditions under which they lived, and under which the latter outstripped their fellows. A particular branch of this subject, which illustrates very well what I mean, is the history of architecture. This history, which might seem to be comparatively far removed from physical geography, is intimately connected with it. One of the points in which it is connected is in the

rocks which furnish building-stones, and in the different character impressed upon the buildings in any district by the materials which are at the builder's disposal. Another side is climate. Climate has had an influence on architecture in determining the shape and covering of buildings, and also in determining the nature of the carving and exterior ornaments that it was worth while to put upon the buildings, because in some climates decorations soon perish, while in others they remain fresh and clear during many centuries. Further, of course, a very interesting side of the history of architecture is the history of the relation of the architecture of one people or political community to the architecture of another, and the influence which the architecture of one community has exercised upon that of another. I remember, for instance, how often the late Mr. Freeman used to insist on the importance of what he called the Burgundian type of architecture. It is one of the types which, until he made it familiar to us, had almost passed out of our minds, and yet it is perfectly true that one does find in certain districts on both sides of the Alps interesting traces of a common type, which become explicable when one remembers what the former political conditions of these countries were. When one begins to consider the former political conditions, one is naturally led to ask what were the physical causes under which they arose. Notice further that there is an extremely interesting aspect under which geography ought always to be studied in relation to history, and that is the change in relation of man to his environment between earlier and later times. This is a special point, which I will do no more than indicate, but you will see how interestingly it might be worked out. While man is still in his primitive stage, not yet civilized, he is in entirely different relation to natural conditions from that which he bears when he has invented arts and sciences, and when he has become master of the forces of nature. In his primitive state, defence against wild creatures and ease of procuring food were his great necessities, but in his more advanced stage it is the facility wherewith he can obtain a supply of those forces of nature which he can bend and use for his own purposes that becomes the most active agent in advancing his further progress.

There is also one aspect of the relations of geography and history which is of great importance, and that is the history of geographical discovery. We do not always, in our teaching of history, give quite enough importance to making the pupil realize the quantity of geographical knowledge which was possessed at different periods of the Earth's history by the various peoples who inhabited it. Many a young man may go through the university course having realized very imperfectly what was the amount of geographical knowledge that was possessed by the ancient world at different epochs, and similarly the steps by which geographical discoveries since the days of the Portuguese in the middle of the fifteenth century have been advanced. It adds much

to the interest of study, and it explains many of the phenomena of history, to make the pupil at every stage of his progress have a picture of the world as then known before his mind, and to realize where it was that darkness lay and on what points light had from time to time fallen during the long progress from the days of Homer to our own, in the discovery of the various continents and oceans of the world. For that purpose we want a greater number of historical maps in our atlases than we generally possess, and I am sure, on the walls of a college lecture-room, nothing could be more serviceable than to have these constantly displayed before the pupil. It may be that in the best historical schools this is now done. It was not so twenty or thirty years ago.

Lastly, the third aspect in which geography comes into education, or rather the third of the aspects that I am asking you to consider, for there are doubtless other aspects, is that in which it is regarded as the basis of commerce. Commerce, reduced to its simplest terms, is an exchange of products, and both the maker of any article and the exporter of that article ought to know where each article can best be produced, whence the raw materials used in manufacture come, which are the places best adapted for manufacture, and where are the best markets. To use the words of Virgil, the merchant ought to know *quid quaeque ferat regis et quid quaeque recuset*, what each country bears and what each country refuses to bear. He ought to know what are the conditions under which the product can be obtained, what are the conditions of labour that determine the getting of it and the transporting of it, what are the markets, whether near or distant, in which it may best be disposed of and where requirements affect its production, and what are the lines of communication and transport along which it can best (most swiftly and profitably) be carried, whether by sea or land.

This commercial side of geography has two aspects. It may be considered either as a question of the direct and immediate utility which it has for the manufacturer or the exporting merchant, or it may be considered as tending to aid in the general expansion of his views and his comprehension of the financial and commercial conditions of the world. Of course it is true that a manufacturer or an exporter will primarily rely upon the direct reports which he receives from his agents abroad. Every considerable manufacturer or exporter, as the case may be, will probably have an agent, or at any rate some adequate source of information, although, no doubt, our merchants have not yet done all they ought to do in providing themselves with such means of information concerning the different markets of the World, so that they may know whence they can best obtain their materials, and whither best send their manufactured products. Although it is chiefly upon these direct reports by trained observers on the spot that the merchant

will rely, he will comprehend the whole subject a great deal better if he has acquired a general mastery of the commercial geography of the world, if he knows the producing areas and the markets and the lines of transport as a whole. A great commercial man, whether he be a great manufacturer or whether he be a great exporter, can develop for himself certain lines of commercial action ; he can frame a large policy upon which he can conduct his operations. In the same way as a general would determine where to distribute his forces, so he will consider where he can best get the materials he wants and to what markets he ought to send them. His wider knowledge of the world as a whole will enable him to take not only a more intelligent, but a more practical and serviceable view of what ought in each particular case to be attempted. His policy will of course frequently need to be varied. It will never do for a man holding so important a position to rely upon what he has learnt years before, because the conditions are constantly changing. What is needed is that he should have a due conception of the magnitude and complexity of the subject, and of the proper methods that must be brought to the study of them. In this way geography may be said to become a branch of; or a sister science with, economic science.

I have felt for many years, and indeed have taken many occasions of urging, that modern commerce, whether it be regarded as an exchange of commodities, or be studied from the side of production or the side of finance, has now become a subject which ought to receive full university recognition. It is a subject which is quite worthy of being treated in a philosophical and scientific way, and of having a place in the curricula of all our universities. That was recognized some little time ago at Liverpool. The University College there started some classes on a small scale, but still with the due appreciation of the principle I have been endeavouring to set forth. Those classes are giving young commercial men an education in what might be called commercial science. I believe the same thing is being done, or going to be done, at Birmingham, and probably elsewhere. It is most satisfactory to know that geography in its relation to economics is now receiving great attention at the London School of Economics, which has now become one of the schools of the new teaching University of London. I learn from the director of the School that these classes are well attended, and that recognition is being given by the university authorities to geography not only in connection with physical science,* but also in connection with economics and history.

The aspects in which I have been endeavouring to regard the teaching of geography are perhaps rather fitter for a university or for

* This is a mistake. Geography is not recognized except in the Faculty of Economics. Of course certain aspects of physical geography are required in geology, but that is very different from a full recognition of geography as a science.—*Editor.*

advanced scholars than they are for a school. At the same time much may be done even in school for pupils between the ages of fourteen and sixteen. There is all the difference in the world between being "elementary" and being "superficial." I would not suggest that schools should deal with the subject if only a superficial treatment could be given to it, but I believe that even elementary knowledge may be made profitable, provided that it is always given in close connection with facts which the pupil can be taught to observe for himself and to reflect on for himself, and not as a mere string of data to be carried in the memory. Let us, however, remember in all these discussions about commercial teaching, that neither it nor any other professional subject must be suffered to interfere with the giving of a general stimulative liberal education. Of course the more you can teach in school, so long as pupils thoroughly understand it, the better; but you cannot specialize to any great extent with boys who are going to leave school at the age of fifteen or sixteen. It is necessary to lift up one's voice against that. But when you deal with young men who are going to remain at a higher secondary school till they are seventeen or eighteen, or are studying at the university, you are dealing with a class from whom will be drawn the upper officers and the what may be called general staff of the army of industry, and you cannot give too much pains and thought to enlarging their views of professional branches of instruction, and giving them an intelligent conception of the phenomena with which they will be concerned in their business life. A large part of those deficiencies in the scientific commercial aptitudes of business men which we hear commented on, springs from the disregard of the needs of those who are going to step into the position of the heads of leading firms. You can hardly overrate the importance in the conduct of any large business, be it a manufacturing or be it a mercantile house, of the possession of a wide and intelligent knowledge of the financial and economic phenomena of the modern World. If you have at the head of the great businesses, of which there are so many in this country, men who have been thoroughly trained to observe these things and to look at them in a scientific way, you will have done a great deal towards helping us to maintain our place among the commercial nations of the World.

I had thought over a number of hints that might be given about methods useful in geographical teaching, but I have come to the conclusion, especially since reading your excellent organ, the *Geographical Teacher*, that it is not likely I should be able to say anything that has not already occurred to the minds of some of you. I am glad to see there is a movement for the education of our examiners. They are by no means abreast of the day in the kind of questions they often put, and it would be a great stimulus to the teachers of geography if they were to find that examinations turned more frequently upon the intelligence

of the pupil, and upon his mastery of the relations of facts to one another, rather than upon the answering of questions for which he must trust to his memory alone. The best teachers have now realized the importance of endeavouring to familiarize pupils with natural objects, and I hope you will not omit any opportunity of pressing even cycling excursions into your service, and of taking boys, as they do in Germany, upon tours by which they can learn more of the physical aspects of the country than they can learn from books. Perhaps you might do more than is generally done to encourage the reading of books of travel. Noting the absorbing devotion which boys now show to journals which contain reports of cricket and football matches, one is disposed to fear that the private reading of boys, which largely used to consist in reading books of history and books of travel, is perhaps not quite so general as it was some thirty or forty years ago. I am quite sure that nothing helps a boy more to take an interest in geography than if he forms a taste for books of travel, and if his teacher encourages him to do so, and talks to him about what he has read. I am glad to think your Association has begun to receive so much support, and now sees such a useful field opening before it. May I, in conclusion, express to the meeting, and in particular to you, Mr. Freshfield, who have done so much for geographical science as a traveller, and have so frequently and forcibly dwelt upon the value of geography in education, my hearty sympathy with your efforts and my hopes that they may be crowned with success.

INTEROCEANIC COMMUNICATION ON THE WESTERN CONTINENT.*

A Study in Commercial Geography.

By Colonel GEORGE EARL CHURCH, M. Am. Soc. C.E.

During the first half of the sixteenth century, it seemed as if nature herself could not withstand the strenuous efforts of the Spanish conquistadores to find, within the tropics, a strait connecting the Atlantic and Pacific oceans. The quest was fruitless; but it fell to the lot of Magellan to discover, far to the south, the one break in the mountain barrier which stretches from the Arctic ocean to Cape Horn. This rent in the Andes is 310 miles long, measured by its windings. If to the violent currents we add the furious and enduring gales which sweep through its western half from the Pacific ocean, we may understand why the Straits of Magellan have always been a terror to navigators, especially to those going westward. It was not until the famous voyage of Le Maire and Schouten, in 1615–16, that the Cape Horn

* Map, p. 317.

route was discovered; thenceforth sailing vessels found it comparatively easy to round the southern extremity of America.

It does not appear probable that any very useful purpose could be served by interoceanic communication across Patagonia between the Straits of Magellan and 40° S. lat.; not so, however, a little further to the north, where the Neuquen extension of the Southern railway of Buenos Ayres has already nearly reached the eastern foothills of the Andes, and promises, ultimately, to have its terminus on the Pacific coast, probably at the port of Talcahuano. Such an extension would put the best port of the Argentine Republic, Bahia Blanca, within reach of the Pacific ocean by about 900 miles of railway, crossing the Andes by a pass about 7000 feet above sea-level. From 36° S. lat. the passes of the Andes rapidly become lower going southward; but north of this latitude they gradually increase in height, and, between 36° and 27°, the lowest is the Uspallata, 12,654 feet, and the lowest between 27° and 23° is 13,911 feet. In the following 915 geographical miles, as far north as 7° 45′ S. lat., there are twenty-eight transitable passes, very few of which are of practical use, their average height above the sea being 15,350 feet, while the lowest one, about lat. 23°, is 12,983 feet. The carrying of an interoceanic railway across South America through any pass north of 36°, if we except the one under construction over the Uspallata, and a possible one to connect the Argentine railway system with Copiapó, in Chile, would not be within the limits of reasonable engineering and finance; and not until South America is densely populated would there be any *raison d'être* for such a line north of the latitude of Copiapó. It may, however, be that some of the Argentine railways in the province of Buenos Ayres may find their way to the Pacific coast. The "Trans-Andine" now lacks but 43 miles to form a connection with the Chilian lines, and thus complete a through route between Buenos Ayres and the port of Valparaiso, a total distance of 881 miles, of which 760 are in the Argentine Republic, and 121 in Chile. The summit tunnel at the Uspallata pass is 10,460 feet above sea-level. When opened to traffic, this railway must have a marked and beneficial effect upon the friendly, political, and commercial relations of the two countries. Its value for passenger traffic and local trade must be great, but we may be allowed to doubt if European merchandise, other than goods of great value, and requiring rapid transit, irrespective of cost, can afford to take this route to Chile in preference to that by the Straits of Magellan, although some European and Asiatic goods may find their way from Valparaiso across the Andes to Mendoza and the western Argentine territory.

The railways which have scaled the Cordillera from the Pacific coast into Bolivia and Perú may be regarded as local lines, which never will become transcontinental, except perhaps in connection with affluents of the river Amazon. The Antofagasta railway might be extended

from Oruro to Cochabamba, and thence to the Chaparé, Chimoré, or Securé branch of the Mamoré affluent of the river Madeira. By some 600 miles of fluvial navigation, the falls of the Madeira would then be reached, where a further length of railway would be required to make the portage of the 263 miles of river barred by nineteen formidable rapids and cataracts. From the lower fall, San Antonio, to the sea, 1533 miles, there is no obstacle to safe and easy navigation for large river-steamers; while in the rainy months this fall may be reached by ocean craft drawing 20 feet of water.

In Perú the difficulties encountered in descending the Atlantic slope of the Andes are enormous. Vast capital would be required to overcome them, and he must be a bold engineer, careless of the relations of engineering to productive expenditure, who can recommend the carrying of any of the existing Peruvian railways down the Andes into the Amazon valley. The lowest pass of the Peruvian Cordillera is in 7° 45′ S. lat., and, according to Raimondi, is but 7170 feet above sea-level. It cannot serve for interoceanic communication; for could a railway be carried across the interminable tangle of profound gorges into which the whole mass of the Andes is broken on this parallel of latitude, it would have to be extended past the *pongos* of the river Marañon to Achual point, east of the Pongo of Manseriche, where the Marañon breaks free from the mountains. Achual point, 2786 miles from the sea, can be reached by vessels drawing 14 feet of water at all seasons, but large ocean steamers can ascend the Amazon to Iquitos within 486 miles of Achual point.

Ecuador offers fewer obstacles than Perú to interoceanic communication. Many travellers who have crossed the continent have taken the route from Guayaquil to Quito, and thence down the Napo river, which drains the slopes of the gigantic volcanoes Antisana, Sincholagua, Cotopaxi, and Cayambé, the last almost cut by the equatorial line; but this route is not the best for a railway, and, if ever connection be established with Amazon navigation, it will probably be across southern Ecuador, and down either the Pastaza or Morona river. These have been the field of numerous explorations with the vain hope of finding one of them sufficiently navigable for purposes of trade between Ecuador and Brazil.

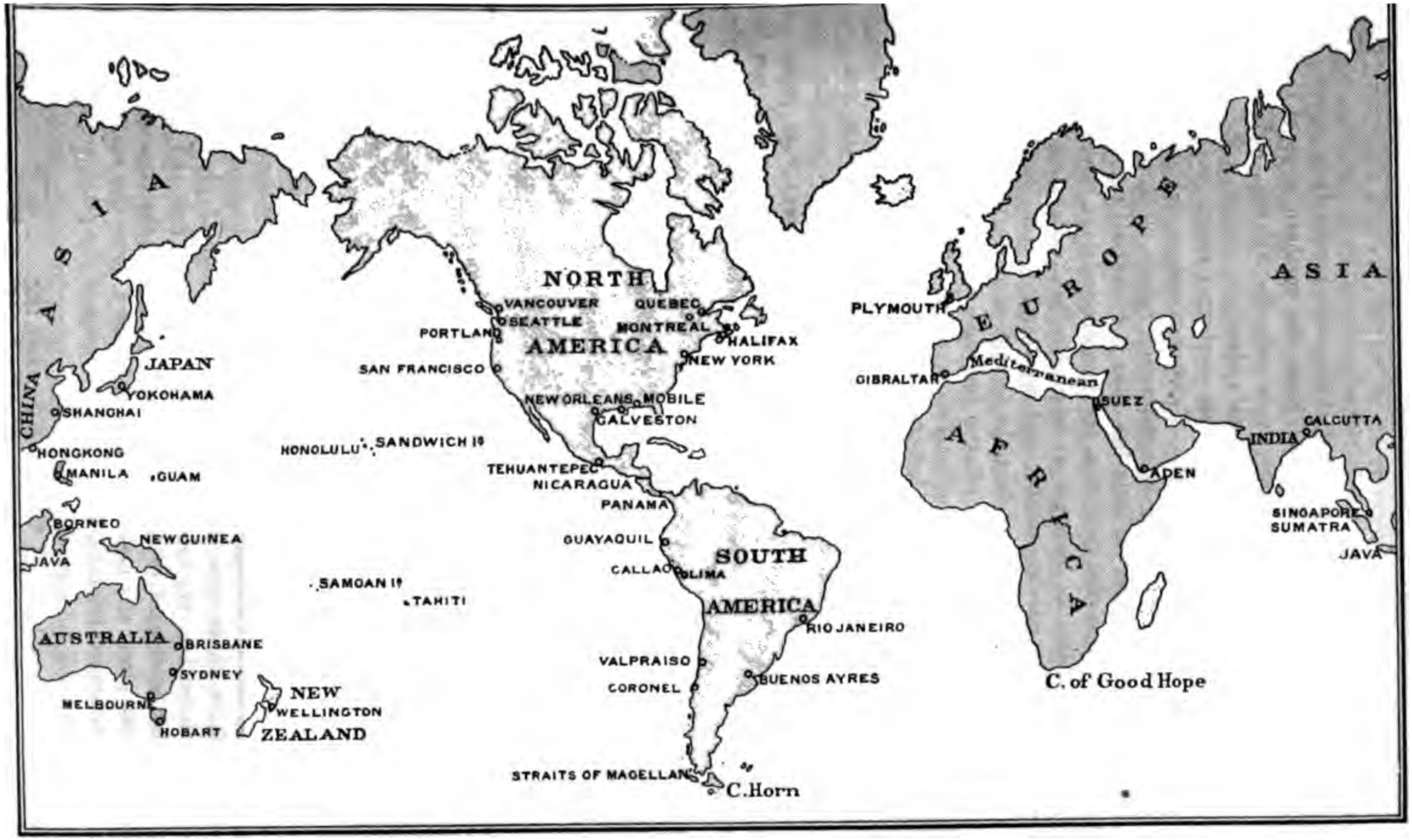
A railway is now under construction from the Gulf of Guayaquil across the Chimbo and Palmira passes of the Andes, probably the most difficult piece of engineering ever attempted in South America. The summit height of the railway, at a tunnel half a mile long, is 10,600 feet above sea-level, the Palmira pass being 12,200. From Guayaquil to Quito, the distance by rail will be 286 miles. The tableland has been reached, and 115 miles are nearly ready for traffic. It is anticipated that the entire railway will be opened to Quito by July, 1902. Some 40 miles of the part already built has gradients of 4 per cent., and over 5

miles are $5\frac{1}{2}$ per cent. The sharpest curves are 191 feet radius. Through the towns of Rio Bamba and Ambato, which are stations on this line, run branches of the Pastaza affluent of the Amazon. It would be of much commercial interest were the railway company to carry a rough preliminary survey down the Pastaza or Morona, to see if they can, by the construction of a branch line, reach a point accessible to Amazon river-steamers; otherwise their railway will serve entirely for the local development of the productive inter-Andean valleys and arid plateaux of Ecuador.

The easiest and shortest transcontinental route which could be opened between Patagonia and Colombia would be from a port in north-west Ecuador, from which the Andean tableland could be reached by rising to 7300 feet above sea-level, and thence, through the eastern chain of mountains, descend to the head of navigation on the Iça branch of the Amazon. Crevaux ascended the Iça, day and night, in a steamer drawing 6 feet of water to Cuemby, and did not find a single rapid. Cuemby is 800 miles above the mouth of the river, and only 200 miles distant in a straight line from the Pacific ocean. It is difficult, however, to understand what important advantages would be gained by the opening of such an interoceanic highway. It seems to be too far north to be of any great value to the commercial development of South America.

The idea of a transcontinental avenue, crossing from the Pacific ocean to any of the navigable branches of the river Orinoco, may be dismissed as impracticable: the Occidental, Central, and Oriental mountain chains of Colombia, with their deep intervening gorges, would always have to be crossed at a right angle, and the descent of the storm-worried slope of the Andes to a point on some affluent of the Orinoco, within reach of the Atlantic by craft of reasonable size, would be an engineering and financial operation as gigantic as it would be unproductive.

We now come to the most interesting region of the Western continent, so far as geography is concerned—Panamá, Costa Rica, and Nicaragua, which once formed part of a vast archipelago, where, winding among its islands, the Caribbean sea connected with the Pacific ocean. This region is now scored by numberless torrential rivers, and is everywhere covered by thick tropical forests, fallen trees, thorny vines, and dense, tangled jungle hiding vast and pestiferous swamps among the mountain ridges and chaos of highlands and hills. From the Andes, north-west, as far as Puertobelo, low sierras, from 500 to 2700 feet high, border the Atlantic coast, but break down a little later at the Chagres river along the line of the projected Panamá canal. Here the summit between the two oceans is only about 300 feet elevation above sea-level; but thence towards, and pushing into, Costa Rica the country gradually rises again, filling the isthmus with complex mountain masses having a maximum height of 7000 feet. West of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PORTLAND
VANCOUVER
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HALIFAX
NEW YORK
NEW ORLEANS
MOBILE
GALVESTON
TEHUANTEPEC
NICARAGUA
PANAMA
GUAYAQUIL
CALLAO
LIMA
SOUTH
AMERICA
RIO JANEIRO
VALPRAISO
CORONEL
BUENOS AYRES
STRAITS OF MAGELLAN
C. Horn
PLYMOUTH
GIBRALTAR
Mediterranean
EUROPE
SUEZ
ADEN
AFRICA
C. of Good Hope
ASIA
INDIA
CALCUTTA
SINGAPORE
SUMATRA
JAVA

Montijo bay, a massive counterfort forms the peninsula of Azuero, with headlands rising to 3000 feet. From the northern slope of the state of Panamá, 149 short rivers empty into the Atlantic, and, from the southern one, 326 flow to the Pacific ocean.

Across Costa Rica, between its northern volcanic section of mountains and the more regular Talamanca range, which extends to the isthmus of Panamá, is a depression (about 20 miles broad from 9° 40′ to 10° N. lat.) a little less than 5000 feet altitude at the water-parting. Eastward from this, the tumultuous river Reventazon flows to the Atlantic through a deeply eroded valley, up which the Costa Rica railway climbs; and westward to the Pacific, flows the little river Pirris. Bounding the depression on the south, the Chirripo Grande mountains send off two immense flanking counterforts, one to the Atlantic, one to the Pacific coast. This transverse, lofty, precipitous barrier almost forbids communication between the northern and southern halves of Costa Rica, both of which present lines of mountain masses instead of serrated crests, which rise at times to above 11,000 feet altitude. In the northern section are the twin volcanoes of Turialba, 11,017 feet, and Irazú 11,200; then come the volcanic masses of Barba, 9335, and Poas, 8675 feet, and thence the irregular, broad, and volcano-dotted chain, about 60 geographical miles long, extending north-west and gradually breaking down until lost at the river Sapoa, one of the boundaries between Costa Rica and Nicaragua. This chain is of eruptive origin, basalts and trachites predominating; but extensive sedimentary rocks are found on its slopes, as well as vast loose deposits of boulders, clay, earth, and volcanic material, the whole generally saturated with water, and sometimes sliding millions of cubic yards of *débris* into the valleys. In fact, I have seen cases where a whole mountain seemed to be moving, and as uncertain in its stability as a sponge. Against the north-eastern slopes of Turialba, Irazú, Barba, and Poas, the north-east rain-laden trade winds beat with relentless force. To quote from my "Costa Rica,"* "I rode from San José across the pass, between Irazú and Barba, nearly to Carillo. The ride to the summit was easy, but rarely in the Andes have I seen such perpendicular, dark, and profound gorges as I found carved out by the storms on the northern slope of Irazú. Although the mountain range behind me had evidently been uplifted, and numerous volcanoes had piled their *débris* high above the general level, to these were due in part the vast inclined plain before me, which, with a very low ridge between the rivers Frio and San Carlos, pushes northward to form the dam which holds Lake Nicaragua in its present place, at a mean elevation of 105 feet above the sea." Among the Nicaragua foothills, at the northern edge of the plain, runs the San

* *Journal R.G.S.*, July, 1897.

Juan river, which is the drainage outlet of the lake; and among the streams which contribute to the volume of the San Juan are the Sarapiqui and San Carlos, fed from the slopes of Irazú, Barba, and Poas. I have seen the Chagres in flood, but doubt if it can match the Sarapiqui, which, from a gentle river, becomes a deep and mighty torrent, in a few hours, when swollen from the storm waters of the mountains. Then it seems irresistible; it picks up boulders of a quarter of a ton weight and whirls them along in its current as if they were little pebbles, at times tossing them over its banks to the right and left.

"One of the affluents of the Sarapiqui, the Amarillo branch of the Sucio (not to be confounded with the Toro Amarillo), which I forded between Guapiles and Carillo, has made wild work over a breadth of from 5 to 6 miles of country, leaving a black, boulder-covered track to mark every change of its erratic moods. Where I crossed it, the boulders were strewed, for half a mile in width, by hundreds of thousands of tons. No wonder, when the river brings its artillery into action, the cannonade may be heard for miles." The plain crossed by the Sarapiqui has taken the place of part of the great strait which once connected the Atlantic and Pacific waters, probably joining the latter near Brito as well as through the depression occupied by Lakes Nicaragua and Managua. Here we have the lowest break in the Andean Rocky mountain chain between the Straits of Magellan and the Arctic sea. It is 153 feet above sea-level, and here is one of the routes available for the remarriage of the oceans.

The isthmus of Panamá, together with the coast to the east as far as the Cabo de Vela, was originally called Castilla del Oro. Oviedo y Valdez estimated its Indian population at 2,000,000, when Pedrarias Dávila was named Captain-General and Governor of the province, in 1513, and commenced his career of human slaughter. The first town there was founded by the famous pilot Juan de la Cosa, after the loss of his two ships. Between the gulf of Uraba (or Darien) and the isthmus of Tehuantepec, we have the region of the New World which, during the first third of the sixteenth century, was the field of search for the strait which was supposed to exist between the Atlantic and Pacific oceans, and which, could it be found, promised to make the monarchs of Spain masters of the commerce of the Orient. Hence the crown constantly urged its adventurers to discover it, and these, regardless of life and treasure, and despite hardships which tested even the courage and fibre of such men as the Spanish conquistadores, persistently pushed their explorations into every inlet, estuary, and river, and through every gap in the forest-covered hills and mountains of the stubborn barrier of land which stood athwart the ambition of their sovereign. The first thirty years of the sixteenth century, so far as the region in question is concerned, may be called the Period of Exploration, dedicated principally to the discovery of the "secret of

the strait." One of the first expeditions was sent, in 1516, from the Pacific side of the isthmus. It found a large gulf to the north-west of Panamá, and gave it the name of San Lucar. The Chinchires indians there gave the explorers to understand that further north there was a communication between the two oceans through a great interior lake. This information was allowed to sleep until after the conquest of Mexico by Cortes, who, in common with Pedrarias Dávila, received urgent orders from the Spanish government, in 1521, "to discover the secret of the strait." At this time, Gil Gonçález de Avila, by virtue of a "capitulacion" made with Charles V., arrived at Panamá with authority to discover a certain extent of country to the north-west of that isthmus. He sailed with an expedition, in January, 1521, for that purpose. In his memorial to his Catholic Majesty,* de Avila says he "has discovered so great a thing as the *Mar dulce*, and from it, and the neighbouring lands, he trusts in God our Lord, and the good fortune of your Majesty, to send to your Majesty an amount of gold sufficiently great to bring to the service of God our Lord all the infidels of Asia and Africa."

The Indian name of the great *Mar dulce* was Cocibolca; but the Spaniards called it Nicaraoagua in honour of the chief Nicarao, who ruled the district. De Avila learned that the lake had a communication with the north sea, but that it was cut off from the south sea by the coast belt of land. He was told that there was another lake north-west of Lake Nicaragua, called Xolotlan (now Managua), which connected with it, and when afterwards he entered the beautiful bay of Chorotega, which he named Fonseca, in honour of the President of the Council of the Indies, the information given him by the Indians led him to believe that Lake Managua had an outlet into that bay. For more than a century, the Spanish maps and descriptions made the great lake of Nicaragua empty into the comparatively insignificant Managua. Certain that he had discovered the "secret of the strait," De Avila hurried back to Panamá. The account of his explorations awoke all the ambition and worst passions of the astute and cruel octogenarian Captain-General Pedrarias Dávila, resulting in the turning of Nicaragua and Honduras into a shambles for several years, with plenty of bloodshed among the followers of rival conquistadores who held conflicting powers from the Spanish crown, each determined to control the region which might become the transit route between Europe and the Indies. In 1527, Diego Lopez Salcedo, a vain, arrogant man, was in command of Nicaragua, with royal instructions to found a city near the outlet of the lake, "because his Majesty desires that the river be explored, and that it be ascertained if it be navigable to the sea, and if it will give

* See 'Coleccion de Documentos para la Historia de Costa Rica,' por Hernandez, vol. iv. Doc. 1. from Archivo General de Indias.

passage between the two oceans." According to the royal will, thus expressed, Salcedo, in 1527, instructed Gabriel de Rojas to discover the drainage canal (the desaguadero) of Lake Nicaragua. It is curious to note that the service of God was secondary to the acquisition of treasure in the mind of the avaricious governor. He says in his instructions,* "At present I am informed, and it is held to be true, that towards the north sea, by the way of the *desaguadero* of the *laguna* of the city of Granada, there are large towns, riches in gold, silver, pearls, and other things; and as it is well for the service of God and of his Majesty, and good for said inhabitants and people of those parts and natives of the land that an end be put to those secrets," etc. Rojas organized his expedition when, in 1528, Pedrarias Dávila superseded Salcedo, and soon after named Martin Estete to carry out the desired exploration. The latter, according to Herrera, took his expedition overland to Nombre de Dios; but Levy, in his work on Nicaragua, says, without stating his authority, that Estete partially descended the *desaguadero*, and named it the San Juan river. It was so dry that he could not pass the rapids. At the death of Pedrarias Dávila, in 1531, Rodrigo de Contreras was Governor of Nicaragua. He gave to Captains Diego Machuca de Çuaço and Alonzo Calero the command of an expedition, about 1534, to explore the river San Juan. According to documents in the Archivo General de Indias, these captains made several voyages to examine the San Juan, in large craft built for the purpose on Lake Nicaragua, and up to 1539 they had made several voyages to Nombre de Dios by the way of the San Juan river.†

In 1540, Comayagua, in Honduras, was founded halfway between the two oceans, with a view to facilitate communication between Puerto Caballos, now Puerto Cortes (founded by Cortes), and the great bay of Fonseca. It was believed that this route for Spanish trade with South America would prove healthier and better than that of Panamá, which was declared by many conquistadores to be the "sepulchre of the living." In 1556, Juan Garcia de Hermosilla pressed this route upon the king as the result of his examination of it, under royal instructions, in 1554. His recommendations were supported by several eminent Spaniards, including the cosmographer Gutierrez. But it was all without result, and the effort of Felipe de Aniñon to revive the idea in a memorial to the king, in 1565, was equally futile, as was also that of Garcia de Palacios in 1578. In 1586, a celebrated Italian engineer, Antonelli, was sent to survey the route, and, with his companion Tejada, made a favourable report upon it in 1591. The opposition, however, from various sources, became too great, and the road was never opened,

* 'Coleccion de Documentos Ineditos,' vol. xiv. Archivo de Indias.

† See Archivo de Indias, Simancas, quoted by Peralta in his 'Costa Rica Nicaragua y Panamá.'

although there is little doubt that in many respects it offered advantages superior to those of Panamá. The distance between Puerto Cortes and the bay of Fonseca, on the line of the surveyed road, is about 200 miles, and the summit elevation 400 feet above sea-level.*

The great Cortes, *facile princeps* among the conquistadores, sent several expeditions in quest of the "strait," the "secret" of which the Crown so persistently urged its captains-general to discover. Scarcely had he obtained control of Central Mexico, than, with methodical and comprehensive genius, he first verified the existence of the South sea, and in his third letter to the Emperor, dated Cuyoacan, May 15, 1522,† he gave an account of his success in this regard. In his fourth letter, October 15, 1524, he says that he has sent Cristóbal Dolid "to colonize the point or cape of Hibueras" (Honduras) "sixty leagues east of the bay of Ascencion to the windward of Yucatan, the coast above Tierra Firme towards Darien, from the fact I have much information that the land is very rich, as well as, in the opinion of many pilots, by that bay a strait leads to the other sea, which is the thing which I, in this world, desire most to hit upon." The activity of Cortes as a geographical explorer was remarkable; with tireless efforts, he at this time fitted out no less than three expeditions, and all from his own private resources—one in Honduras, one "to examine the whole coast of the bay of Asuncion in search of the strait believed to exist there," and the third for Guatemala. It is evident that his masterful mind never rested in the search for geographical knowledge regarding every part of the New World, and that even the Atlantic coast-line of North America was probably known to him before its outline became known in Europe in July, 1524, as the result of Verrazano's voyage; for he searched for the coveted "strait" "from the coast of Florida to the *bacallaos*"—the cod-fisheries. In 1524 he says, "Thus I think of sending the vessels which I have had built in the South sea, which, if it please God, will sail at the end of the month of July of this year, by the same coast southward in search of said strait; for if it exist it cannot escape the notice of either those going south or of the others by the North sea; because those of the South will follow the coast until they find said strait, or until the land reaches that discovered by Magellan; and the others of the North, as I have said, until it joins the *bacallaos*. Thus, on one side or the other, the secret cannot fail to be known."

"A knowledge of the Atlantic coast-line of North America must have closely followed on the discovery of Florida. There can be no

* 'Honduras, Descriptive, Historical, and Statistical.' By E. G. Squier.

† 'Cartas del famoso Conquistador Hernan Cortes, al Emperador, Carlos Quinto.' Mexico. 1870.

doubt that in these early years many voyages were made to the shores of the New World of which no record remains, . . . these were undertaken in search of the strait leading, by a western passage, to the Indian ocean, which had been sought ever since Columbus reached the great barrier of the American shore." *

In practice it has been found that Panamá offers a better crossing between the Atlantic and Pacific oceans than any other point. It was the route used by Spain, up to 1726, for her *flota* and *galeon* trade with the west coast of South America. Her fleets, after leaving Cartagena, proceeded to Puertobelo, near the present port of Colon, and their cargoes were then carried across the isthmus. The road was a rude one, but by dint of slave labour and much sacrifice of life, it was made serviceable to the extent demanded by the limited commerce of the times.

When swarms of buccaneers had made the voyages of Spanish ships to and from Cartagena extremely dangerous, and an English fleet, under Admiral Vernon, had, in 1740, pounded Cartagena and Puertobelo to pieces, Spain almost entirely abandoned this highway to Peru in favour of the one by Cape Horn, which Le Maire and Schouten had demonstrated to be practicable. The treasure-hunter changed his route, and Panamá was left in comparative rest, until about a century later it found itself on the line of quickest transit between the Atlantic coast of the United States and the territory of California, acquired by the United States from Mexico, under the Treaty of Guadalupe Hidalgo. Again the thirst for gold drove humanity and merchandise in an almost ceaseless stream over the old Spanish road across the isthmus of Panamá; but this time the current was Anglo-Saxon—the Spanish one had been completely diverted, and confined, in the New World, to Cuba and Puerto Rico. Meanwhile, the long period of exploration had demonstrated that the only way to correct the blunder of nature was to unite the oceans by a ship-canal, and from that day to this the problem has been where to cut it. Almost numberless expeditions have been despatched to study it, and, from the Atrato river to Tehúantepec, many routes have been surveyed by able engineers. Whoever casts his eyes upon a map of the narrow barrier joining North and South America, instinctively projects a canal across it. Thus it is Vasco Nuñez de Balboa, the discoverer of the Pacific ocean, and no one else, to whom the honour should be given of being the original projector of a Panamá maritime canal. It was Cortes who first called attention to the geographical advantages possessed by the isthmus of Tehúantepec, and, after abandoning all hope of discovering the "secret of the strait," he wrote, in his fifth letter to Charles V., 1526, "as no strait can be

* E. J. Payne, in his 'History of the New World called America.'

discovered, I think of making a road by this way for the Spice islands." Here the Emperor conceded to him the vast estates, of about 300 square miles, still known as the Marquesanas, while another part of his Marquisate comprised the town of Tehúantepec and the harbours of Zacatula and Acapulco. He thus controlled the best points on the Pacific coast of New Spain for communication with the Indies. Acapulco, during the colonial period, became the galeon port for the Spanish trade with the Philippines.

Since the days of Cortes, the isthmus of Tehúantepec has been considered a probable interoceanic route, and in 1814, according to José de Garay, the Spanish government, in view of the various reports, authorized the cutting of a canal there in preference to Nicaragua or Panamá. After the independence of Mexico, the government of Mexico gave de Garay a privilege to open communications "by canal or railway" across Tehúantepec, but it lapsed. Since then, nearly a dozen fruitless concessions have been granted with the same object in view, until, tired of giving them, Mexico unwisely built the existing railway for government account. The line is 192 miles long from port to port, and its summit height 886 feet above sea-level. The enterprise was of great commercial importance until the restless wave of humanity commenced to chase railways across the continent further to the north; but once these reached the Pacific coast, the geographical advantages of Central America were flanked, and Tehúantepec, like Panamá, became of little consequence in the world's trade.

Railway communication across Costa Rica will ultimately be opened. The English company's line extends from Port Limon, on the Caribbean sea, to Alajuela *viâ* the capital San José, which is on the Pacific slope. From Limon to the latter city it is 103 miles, and the summit height, at the ninety-second mile, is 5102 feet above sea-level. The government is now building a line from San José to the Pacific coast; when completed, it will form part of an interoceanic route, of but little value for through trade.

It is a remarkable coincidence that on the same day that the Treaty of Guadalupe Hidalgo was signed, February 2, 1848, ceding California to the United States, gold was discovered at Sutter's mill, 40 miles from Sacramento. The news crossed the continent, and reached New York in November of the same year. Then commenced the rush for the west coast of North America. The story of the birth of empire in California I heard from the lips of the grand old pioneer, Captain Sutter himself, who died a penniless wanderer. Thousands of fortune-hunters embarked from the Atlantic ports of America in rapid succession; some of them crossed the isthmus of Panamá, others Nicaragua, and many found their way to the goldfields by rounding Cape Horn. It was a recrudescence of the old Spanish gold-fever, during the delirium of which, in the sixteenth century, crowds of

adventurers traversed the same interoceanic barrier in quest of the precious metals. The direct journey across the continent, in 1848, could only be made along trails constantly threatened by indians. Hence fever-stricken Panamá became the great highway, although for a time partly rivalled by the route of the San Juan river and Nicaragua, until the demands of travel and commerce called the Panamá railway into existence. This was the first interoceanic railway ever built. It is 47½ miles long, was commenced in 1850, and the first locomotive passed over it from ocean to ocean January 28, 1855. Its construction accentuated the importance of an interoceanic canal, and the right to cut this was included in the railway concession from Colombia.

The original Spanish road from Nombre de Dios to the south side of the isthmus, 18 leagues of misery and curses, was much improved by a change which, by the way of the river Chagres, brought the journey more within the limits of human endurance and Christian fortitude. How painful it was to man and beast in Spanish times is shown by the cost of transportation of goods, which, according to the memorial of Diego de Mercado to Philip III. (1620),* was, "from Puertobelo to Panamá, for ordinary merchandise, $25 to $30 of assayed silver for every 200 lbs.," say from £55 to £65 per ton. It is evident that, under such conditions, trade could not be carried on except to an extremely limited extent; hence, in the middle of the last century, the Panamá railway came to the relief of man and brute as they struggled to the death in the floods, swamps, mud, tropical rains, and scorching sunshine, across the pestilential isthmus to meet the heartless requirements of trade. An iron track and the modern locomotive solved the transit problem for a time; but no one then realized that, further to the north, the locomotive was destined to outflank a merely geographical position, and largely destroy the value which nature had apparently given to it. So far as trade routes were then concerned, Panamá was strategic to the highest degree, and why should it not remain so? Nations, since the days when the merchants of the Euphrates wrote their bills on terra-cotta plaques, had seized on the most commanding geographical points for political and commercial control, but these could alone be made valuable in connection with means of transportation, which were the sailing ship, horse, ass, camel, ox, elephant, and llama. Six thousand years of experience with them cause us, with a species of atavism, to cling to them at times, and to overlook the fact that the locomotive and steamship make geographical advantages of secondary consideration in the selection of trade routes. Were overland transportation still carried on by ancient methods, an interoceanic canal

* 'El Canal Interoceanico de Nicaragua y Costa Rica en 1620 y en 1887.' By Manuel M. de Peralta.

across Panamá or Nicaragua would be an inestimable boon to the commerce of the world, and we might safely follow the lead of Charles V., and the kings who succeeded him, in the effort to break through the barrier which divides the oceans.

It is a common opinion that the success of the Suez canal is a proof that one at Panamá will be equally successful. A canal, to unite the Mediterranean and Red seas, is first cut by the engineers of Rameses II.; afterwards, choked with sands, it is reopened by Pharaoh Necho, and utilized by his great fleets; again it is buried by the desert, and, after a lapse of centuries, the Persians, under Darius Hystaspes, make a fruitless effort to restore the waterway. The desert remains the master, until the great Frenchman, Lesseps, appears, and, delving beneath the forgetfulness of nearly twenty-five centuries, with the aid of French capital and Egyptian forced labour, restores the connection between the two seas, and gives us the modern Suez canal, now active with the commerce of the world; not carried in the little craft of the Pharaohs, but in that gigantic compendium of all civilization, the modern steamship.

If Lesseps could accomplish such marvellous results in the East, why not in the West, influenced and urged on by the financial enthusiasm created by the success of Suez? If Suez gave such excellent returns upon its capitalization, why should not Panamá, "similarly situated," do the same? What mattered if the new project involved, not the cutting of a canal through a level desert in the temperate zone, but through a tropical, inhospitable mountainous region, saturated by a yearly rainfall of 10 feet?

And thus the work was undertaken, and the engineers of England and the United States, if not of other countries, looked on astounded at the *gaieté de cœur* with which the assault was delivered. From the ruins of the undertaking "The New Panamá Canal Company" emerged, October 20, 1894, to spend such moneys as could be saved out of the wreck of the old one,* and to demonstrate, by thorough engineering studies and continuation of the work, that the enterprise is feasible, but on the basis of a canal with locks, in substitution of the original project of a canal at sea-level throughout.

In a publication of the new Panamá Canal Company of 1899, they say, "The work was commenced in 1881. After employing two or three years in making more careful and thorough surveys, and in preparatory work, the real difficulties of the undertaking began to be understood. . . . It must be recalled that there had been great want of

* "The old Panamá Canal Company and the Liquidator raised by the sale of stock and bonds the sum of $246,706,432. The securities issued to raise this money had a par value of $435,559,333. There had been excavated about 72,000,000 cubic yards prior to the organization of the new company" (*vide* 'Preliminary Report of the Isthmian Canal Commission,' November 30, 1900).

foresight in proportion to the importance of the work, and this explains the grave consequences which ensued. . . . The expenditure actually made upon the isthmus amounted to £31,300,000."

In June, 1899, the United States Government appointed a commission of eight eminent engineers, under the presidency of Admiral Walker, "to determine the most feasible and practical route across the American isthmus for a maritime canal between the Atlantic and Pacific oceans." Thirty-one working parties were organized and sent into the field, of which twenty for Nicaragua, five for Panamá, and six for the Darien country.

According to the report of the commission, the surveys show that the Nicaragua and Panamá routes are the only feasible ones; but it appears that the concession of the Panamá Railway Company, controlled by the New Panamá Canal Company, will expire August 16, 1966, and should the latter fail to comply with its own concession, which entitles it to the usufruct of the canal until October 31, 2009 (always providing it be opened to traffic by October 31, 1910, now an impossibility), it will have to fall back on the railroad concession, the canal, at the termination of the time period, becoming the property of the Colombian Government, without compensation. Other vexatious conditions environ both concessions. To add to the complications, the old Panamá Canal Company is entitled to 60 per cent. of the net earnings of the new company. Laying aside the questions of engineering, cost of works, value of geographical position, and the difficulties incident to negotiating with the old and new canal companies, the United States would hardly be justified in committing itself to the Panamá route without first concluding a treaty with Colombia, making the canal concession perpetual, especially as such a treaty might be negotiated with the two governments controlling the proposed Nicaragua route.

The technical features of the rival canal routes are substantially as follows:—*

NICARAGUA.—The lake has an area of about 3000 square miles. There are reasons to believe that its surface is sometimes as high as 110 feet above sea-level, and then again as low as 97. It is separated from the Pacific ocean by the continental divide, from 12 to 30 miles wide, with a summit height of 153 feet above sea-level. It discharges into the Caribbean sea through the San Juan river, which is tortuous and flows through a hilly country in its upper part. The distance from the lake outlet to the mouth of the river is about 80 miles in an air line, but about 120 by the windings of the river. The annual rainfall near Greytown sometimes amounts to 300 inches. The average

* 'Report of the Isthmian Canal Commission, 1899–1901.' 55th Congress, Senate Document 54. Washington, 1901. Also Preliminary Report, November 30, 1900

is probably 260 to 270. In the drainage of Lake Nicaragua, the yearly fall is about 65 inches.*

The total length of the canal is—

	Miles.
From the Caribbean sea to the lake, including about 28 miles of river improvement and about 17 not requiring improvement	95·81
Lake crossing, including the excavation of 28·73 miles of channel	70·51
Crossing of continental divide to Brito on the Pacific	17·34
Total from ocean to ocean	183·66

Estimated cost, $189,864,062.

A ship drawing 32½ feet of salt water will draw nearly one foot more in fresh water, and require for safe navigation not less than 35 feet of water in the canal. This depth is therefore fixed as the minimum in all the channels. "The broadest battleship afloat is the *Regina Margherita*, recently launched. . . . The increase in the beam of warships is unmistakable; . . . the width of locks is therefore fixed at 80 feet, with a view to provide for some further increase." The largest commercial ships are longer than the largest warships; therefore the length of locks is fixed at 740 feet. The bottom width of the canal is to be 150 feet. That of Suez is now 115, and its depth 27 feet 10 inches. Twin locks are to be provided in every case. Lake Nicaragua will be reached from the Atlantic side with one lock of 36·5 feet lift, two of 18·5 feet, and one of from 31 to 37 feet lift. The descent to the Pacific from the lake will be by one lock of 22·5 to 28·5, two of 28·5, and one of 20·5 feet lift at mean high water, or 28·5 feet at mean low water. By means of dams and regulating works, the lake-level is to be held within a limit of 6 feet fluctuating elevation, or from 104 to 110 feet above mean sea-level. The most difficult engineering work will be the Conchuda dam, estimated to require four years to build. The greatest depth to hard rock will be 82 feet, the crest of the dam above its foundation 135 feet, and its total length 1271 feet, with foundations on hard rock the entire distance. There are heavy cuttings near San Carlos and Tamborcito, the maximum near the former place having a depth of 218 and 170 feet "for short distances, while at Tamborcito, 26 miles from Greytown, there is a cut 297 feet deep for a distance, at the base, of 3000 feet, nearly all hard rock." Greytown harbour, once excellent, is now silted up and almost obliterated. It is proposed to excavate it to a depth of at least 35 feet, the area to be protected by jetties, "and its maintenance will require an extension of the jetties or dredging, or both." An artificial harbour has also to be constructed at Brito, but the maintenance will be less costly than the one at the Atlantic entrance to the canal.

* The alignment is inferior to that of the Panamá canal. The sharpest curve is 4045 feet, and the total curvature 2340 degrees.

Panamá.—The location selected by the commission is, in general, the same as that proposed by the French company. The total length, from 36 feet deep in the Atlantic to the same depth in the Pacific, is 49·09 miles; but from the inner end of the harbour of Colon to the shore end of the Boca channel on the Pacific side it is 42·3 miles, of which 11 miles will be in the broad channel of the artificial lake Bohio. The alignment is exceptionally good, the sharpest curve having a radius of 6232 feet, except one of 3280 at the entrance to Colon harbour. The total curvature of the canal is 771°. From the inner end of the harbour at Colon, a level length of 14·42 miles will reach the Bohio double flight of locks, which will have a total lift of 82 feet at the minimum level of the proposed Bohio lake, to 90 feet at its maximum, or 41 to 45 feet lift at each lock. There are to be four lock-chambers in all, of the same type as those designed for Nicaragua. Their estimated cost, including excavation, is $11,567,275.

In the construction of a ship-canal at Panamá, a problem of the first magnitude is the control of the Chagres river. It is about 145 miles long, with a drainage area of 875 square miles. It flows through a mountainous district which has an average yearly rainfall of about 130 inches. A maximum fall of 6 inches in twelve hours has been observed. The precipitous slopes of the valley give the stream a torrential character. It rose at Gamboa, in December, 1891, 23 feet in sixteen hours. It is the formidable obstacle to the cutting of a sea-level canal as originally projected by Lesseps. The quantity of excavation required for such a canal has been roughly computed at 266,228,000 cubic yards, and twenty years as the time required to complete it. Therefore, although physically practicable, it has been rejected in favour of a canal with locks. In consequence, the Chagres river must be impounded, and it is proposed to build a dam at Bohio for this purpose, and form a great reservoir, to be called Lake Bohio. This will have a normal water surface of 38·5 square miles, increasing to 43 when the lake reaches its maximum level, when it will contain over 210,000,000 cubic yards of water.

The Bohio dam will be the most important work of art on the line, and its foundations, which will be on rock, are to be 128 feet below sea-level. Its length will be 2546 feet, and its top 100 feet above sea-level. Therefore the total height of the dam, from foundation to crest, will be 228 feet. It will have a masonry core 30 feet thick at and below −30, with earth faces designed to have mean slopes of one vertical to three horizontal, broken by three terraces, each 6 feet wide. It is probable that both faces will be heavily riprapped with the rock spoil from the lock excavation. The cost of the dam is estimated at $6,369,640, a higher estimate than any heretofore made. Lake Bohio will form part of the canal itself for a distance of 12·68 miles. Ships will reach it by the flight of Bohio locks above mentioned.

Leaving the lake, the celebrated Culebra cutting is entered; this is 7·91 miles long, from the Obispo guard-gates, near the lake, to the Pedro Miguel locks, by which the descent to the Pacific ocean will be in great part effected. The summit of the cutting is about 5 miles distant from the Obispo gates, where the bottom of the canal at the axis will be 286 feet below the natural surface of the ground. Soft materials on top, some hard rock at the east end, 2 miles of ordinary materials at the western end, and the remainder of indurated clay and some strata and dikes of hard rock, are the characteristics of this gigantic excavation of 43,237,200 cubic yards, which, it is thought, will require eight years to complete. The entire cut will be lined with masonry walls to 2 feet above high water. There will be a bench 38 feet wide on either side, on one of which the Panamá railway will be laid, while it is probable that a service track will occupy the other. The estimated cost of the 6·02 miles of heavy work is $41,940,480, and of the 7·91 miles, $44,414,000, including the upper approach to the Pedro Miguel locks. These will be similar to the Bohio ones, and will have an aggregate lift of from 54 to 62 feet. A level of 1·33 miles will extend from them to the Miraflores lock, the last required to reach the ocean, and which will have a lift varying from 18 feet at high tide and 38 feet of mean low tide. For 4·12 miles beyond the Miraflores lock, the canal goes through a low swampy country to a point called La Boca, where there is a substantial wharf, and from here a 4·41-mile channel will be excavated to the 6-fathom line in Panamá bay.

The total estimated expenditure required to complete the canal is, including 20 per cent. contingencies, $144,233,358. The value of the work already done is computed at $36,324,033, which includes $2,000,000 for maps, drawings, and records; but the Isthmian Canal Commission adds for contingencies "to cover omissions" sufficient to make the total $40,000,000.

There is a third route which seems to again be seeking favour, and that is the old Darien one, known as the San Blas, from the great gulf of that name on the Atlantic side of the isthmus. It is supported by a strong group of capitalists, headed by Senator Hanna, whose political power is well known. Under the able scientific guidance of General Edward W. Serrell, one of the most eminent engineers in the United States, they seem to be gaining ground at Washington, and, possibly, may yet induce Congress to seriously consider the advantages which they claim for their project. "The length of canal would be 27 miles only, in a straight line, and cut at sea-level, without locks, at an estimated cost of £22,000,000. Twenty-three miles will be through a low flat country, and the other four a gigantic tunnel through the solid rock of a mountain ridge, about 1200 feet high at its summit," the tunnel to admit the passage of the largest ships.

Some rough examinations were made of this route, in 1870, by a United States expedition under Commander Selfridge. He estimated the length of the required tunnel at 10 miles, and pronounced it impracticable. The length of the canal would be 27 miles from ship navigation on the Mandinga river, flowing to the Atlantic, to ship navigation on the Bayamo river, emptying into the Pacific; but the width of the isthmus from ocean to ocean is 37 miles. "In the north-west corner of the great gulf of San Blas is an inner harbour formed by a circle of islands, with a passage a mile wide leading into it, capable of holding easily all the shipping that an immense traffic might demand of it. This harbour, magnificent for all purposes required as the great terminus of an interoceanic canal, was sufficient in itself to attract attention to this portion of the isthmus." The 'Preliminary Report of the Isthmian Canal Commission' (1900) says, "The San Blas route extends from the bay of that name to the mouth of the Bayamo, on the Pacific; it has been advocated as the shortest line between the two oceans, which is true. The most complete plan developed involves a tunnel at least 7 miles long. While not necessarily impracticable, such a tunnel would be very objectionable, and would render the line inferior to the Panamá or the Nicaragua location."

Thus the doctors disagree, the great element of uncertainty being the tunnel. If this be only 4 or 5 miles long, is not San Blas the best route?

As to Geographical Position.—About 94 per cent. of the population of the world inhabit countries lying north of the latitude of the projected Nicaragua and Panamá canals. It may be difficult to show that any large proportion of the southern 6 per cent. are commercially interested in the realization of either project. It is generally supposed that the isthmus of Panamá occupies as commanding a trade position as that of Suez; but the parallel of latitude of Suez (30°) cuts through or runs in the neighbourhood of the densest area of population of our globe. Hundreds of millions of Asiatic people, at the eastern doorway of Suez, are constantly exchanging their products for those of Europe lying at the Mediterranean entrance, and yet the shipping passing along this very ancient highway does not yet reach ten millions of net tons yearly.

In estimating the advantages of the Nicaragua or the Panamá canal to the general trade of the world, the following tables of distances seem important. They are in nautical miles, and each case represents the distance which a full-powered steamship has to sail from her port of departure to her destination. It does not appear necessary to give a similar table of routes taken by sailing ships, for they will probably be very little used for voyages through any interoceanic canal;—

	Miles.
Plymouth, England, to Panamá	4580
New York „	2021
New Orleans „	1420
Panamá to Acapulco	1437
„ San Francisco	3277
„ Esquimalt	3840
„ Guayaquil	842
„ Callao	1337
„ Iquique	1999
„ Valparaiso	2608
„ Punta Arenas, in Straits of Magellan	3932
„ Tahiti	4530
„ Apia	5739
„ Honolulu	4665

Viâ STRAITS OF MAGELLAN.

	From New York.	From Plymouth.
To Rio de Janeiro	4778	5130
„ Montevideo	5768	6110
„ Punta Arenas	7035	7350
„ Valparaiso	8460	8775
„ Iquique	9220	9535
„ Callao	9701	10,016
„ Panamá	10,967	11,282
„ San Francisco	13,234	13,549
„ Esquimalt	13,920	14,235

TO ASIATIC COAST AND ISLANDS.

	Miles.
From San Francisco to Honolulu	2100
„ „ Yokohama	4536
„ „ Shanghai	5550
„ „ Hong Hong	6086
„ „ Manila	6254
„ „ Sydney	6514
„ „ Singapore	7330
Honolulu to Yokohama	3400
„ Hong Kong	4961
„ Guam	3337
Guam to Manila	1506
Manila to Singapore	1386
Tahiti to Sydney	3300

DISTANCES FROM NEW YORK AND PLYMOUTH *viâ* STRAITS OF MAGELLAN AND *viâ* CAPE OF GOOD HOPE.

	Viâ Straits.	*Viâ* Cape.		*Viâ* Straits.	*Viâ* Cape.	
From New York	12,896	12,670	to Melbourne	13,211	11,870	from Plymouth.
	12,693	13,140	„ Sydney	13,008	12.340	
	11,413	13,710	„ Wellington	11,728	12,910	
	16,815	13,530	„ Manila	17,130	12,736	
	16,696	12,150	„ Singapore	17,011	11,850	
	17,132	13,590	„ Hong Kong	17,447	12,790	
	17,003	14,340	„ Shanghai	17,324	13,540	
	16,281	15,020	„ Yokohama	16,599	14,220	

PANAMÁ ROUTE TO COAST OF ASIA AND ISLANDS OF THE PACIFIC OCEAN *versus* SUEZ CANAL ROUTE.

	Viâ Panamá.	Viâ Suez.		Viâ Panamá.	Viâ Suez.	
From New York	10,016	12,790	to Melbourne	12,575	10,670	from Plymouth.
	9,851	13,320	„ Sydney	12,410	11,200	
	8,533	14,230	„ Wellington	11,092	12,110	
	11,521	11,556	„ Manila	14,080	9,436	
	12,915	10,170	„ Singapore	15,474	8,050	
	11,603	11,610	„ Hong Kong	14,162	9,490	
	11,726	12,360	Shanghai	14,285	10,240	
	10,086	13,040	Yokohama	12,645	10,920	

NOTE.—All of the above distances are taken from 'Tracks for Full-powered Steam-vessels, with the Shortest Navigable Distances in Nautical Miles,' published by the United States Hydrographic Office, 1900, and from the Admiralty chart of 1888. Some discrepancies exist between them, which I have carefully adjusted.

It is obvious that the primary reason for cutting an American maritime canal is to save *distance*; therefore no objection can be urged if we take *distance* as the basis for estimating its advantages to the commercial world. In consequence, it appears justifiable to eliminate from its influence those countries the ships of which can find shorter routes for their voyages than the one *viâ* Nicaragua or Panamá. Having in this manner reduced the area from which the canal may draw its traffic, we may then roughly estimate what part of the trade tonnage of that area it may hope to obtain. Thus reasoning, and keeping in view the above distance tables, we may at once eliminate the whole inter-commercial movement between Europe, Asia, and Africa. The distance from Plymouth to Singapore by Suez is 7424 miles less than *viâ* Panamá, and 1725 miles less to Yokohama. Indeed, Plymouth is 745 miles nearer to Shanghai by way of the Cape of Good Hope than by a Panamá canal route. Thus *distance* says that for the inter-trade ot Europe, Asia, and Africa a Panamá canal will be useless. Almost the entire tonnage and revenues of the Suez canal are derived from that trade. Hence to estimate the probable traffic of a Nicaragua or a Panamá canal at several million tons, simply because the Suez canal shows about ten million net tons of shipping, from the sources indicated, does not appear to be logical.

We may further eliminate from control of the Panamá canal all trade between Europe and Australia, Sydney being about 12,410 miles distant from Plymouth by the Panamá route, and 11,200 by Suez. Wellington, New Zealand, is 11,728 miles *viâ* Straits of Magellan, and only 636 miles less *viâ* Panamá—a difference which would be cancelled by the canal tolls.

The analysis, thus far, seems to eliminate from the influence of the Panamá canal the whole inter-trade of by far the greater part of the land surface, and over nine-tenths of the population of the globe. Our

inquiry is thus narrowed, so far as the Old World is concerned, to the attractions which an American canal may have for European trade with the Pacific side of the Western Continent. In this, however, it is evident that the canal tolls will, to a considerable extent, be a governing factor.

With the traffic problem limited, we may now proceed to study the commercial movement of the west coast of South and North America. Of the continental drainage of the former, 89 per cent. finds its way to the Atlantic ocean, and 6 per cent. to the Pacific, 5 per cent. being absorbed by the thirsty inter-Andean section. From Panamá to southern Ecuador, the Pacific slope of the Andes is a dense, almost impenetrable jungle. Then commences the dry desert, which extends to 33° S. lat. The height of the Andean passes * forbids their becoming the trade avenues of any important part of the east slope of the Andes, and thus, south of Panamá as far as the Straits of Magellan, foreign commerce must consist almost entirely of the imports and exports of the small area of South America which drains into the Pacific ocean.

Numerous attempts have been made to estimate approximately the probable traffic of a Panamá canal. They have been based almost wholly upon official statistics of tonnage entrances and clearances of ships. It is this method which has so swollen the estimates, and given results which are unreliable. Take, for instance, the commerce of the west coast of South America—counted in this way it is gigantic. The coasting trade is done by foreign steamships, and a single 2000-ton vessel, running from Panamá to Valparaiso, and, during every trip, *entered and cleared* perhaps at a dozen ports, picking up or discharging a few tons of freight at each, may add yearly 200,000 to 300,000 tons of *entrances and clearances* to the commercial record. So also with the Central American states and Mexico; the little port of Punta Arenas, in Costa Rica, shows a movement of 323,000 tons, although its actual import and export trade is only about 12,000 tons. Thus millions of tons of traffic, heretofore credited to a canal, represent the cargoes of "Flying Dutchmen." In fact, an analysis of its probable traffic is one of the most hallucinating of problems. It involves a knowledge of the weight of all exports and imports; and the Pacific coast countries, except in one or two uncertain cases, give no weights of goods, only their valuation for customs purposes; thus one is almost invariably obliged to fix an average cash value per ton on both exports and imports to arrive at the approximate tonnage; and, if disposed to take an exaggerated view of the traffic possibilities of a canal, may swell them to almost any figure. Then, also, the steamship *versus* the sailing ship

* "South America: An Outline of its Physical Geography." By G. E. Church. *Royal Geo. Soc. Journal*, April, 1901.

has to be considered, the varying net register of ships in comparison to cargo capacity, trade winds, ocean currents, coaling-stations and cost of coal, seasons when products of various countries are in most demand and require the most rapid means of transportation—these and other uncertain factors of importance are involved in the vexed problem. Thus men of marked ability and good faith who have tried to solve it constantly change their figures, as Lesseps did up to the collapse of his Panamá company, and as the private American companies which have attempted a Nicaragua canal have done. Thus, presenting weapons to any expert who may wish to challenge my estimate, I offer the following:—

South American Trade upon which an American Interoceanic Canal must depend.

		Imports. £	Exports. £
1900	Chile	9,640,360	12,575,598
1899	Peru	2,106,640	3,361,520
1898	Ecuador	1,000,000	1,257,978
1900	Nicaragua	703,490	792,203
1899	Honduras	280,803	231,014
1900	San Salvador	600,000	914,269
1898	Guatemala	900,000	1,674,000
1899	Mexico	272,289	726,393
		15,503,582	21,532,975

The general value of Spanish American imports on the Pacific coast, I calculate at the rate of £25 per ton. The exports vary in value according to the countries. Coal is reckoned at a separate valuation. The ton of merchandise is taken at 2240 lbs. in all cases.

Chile.

	Imports	£9,640,360
Deduct coal	674,746 tons, value	1,012,000
		£8,628,360 =
	345,134 „ at £25	
Total imports ...	1,019,880 „	

Deduct 523,209 tons of coal and goods from Pacific ocean countries, and we have 496,671 tons of cargo for North Atlantic ports. But it must be borne in mind that the distance between Europe and Valparaiso is but 1587 miles greater by way of the Straits of Magellan than by the Panamá route, and that eight-tenths of the imports of Chili enter through Valparaiso and ports to the south of that principal emporium of the country.

Exports		£12,575,598
Actual tonnage of nitrate, 1,389,000 tons at £6	= £8,334,000	
Exports to Pacific coast countries, Argentine and Brazil	950,000	
		9,284,000
		£3,291,598 =
164,579 tons at £20 for North Atlantic		

For Chile, therefore, we have—

Imports	496,671 tons
Exports of nitrate	1,389,000 „
„ merchandise	164,579 „
Total North Atlantic trade	2,050,250 „

The "Permanent Nitrate Committee," of London, has kindly informed me "that 76·14 per cent. of the nitrate tonnage is carried by sailing ships, and, although the percentage by steamers is gradually increasing, sailing ships will continue to have the preference (except to load in the first three months of the year for season arrival) as long as suitable ships continue to be built. Freight by steamer is from one to two shillings per ton higher than by sail. In the nitrate trade a ship's cargo is generally about 60 per cent. greater than the registered tonnage. Sailing craft average ninety-eight days for the voyage from Peru to England, and steamers, fifty-six days.

"The largest quantity of nitrate is shipped in the months of October, November, and December. There is much diversity of opinion among experts as to the life of the nitrate beds, but it is believed that there will be no rapid decrease in output for the next twenty years."

The Pacific coast trade of Bolivia is credited to Peru and Chilé, across which countries it passes.

PERU.

Imports		£2,106,640
From China and Pacific coast	£440,547	
By way of Iquitos on Amazon	233,155	
		673,702
		£1,432,938 =
57,316 tons at £25		
Exports		£3,361,520
To Pacific countries and from Iquitos		993,804
		£2,367,716 =
236,772 tons, at say £10		

From Peru, therefore, we have—

Imports	57,316 tons
Exports	236,772 „
Total North Atlantic trade	294,088 „

Ecuador.

Estimated *Imports*, £1,000,000

There are no statistics for a recent year, but the value of imports at Guayaquil for the first six months of 1898 was £434,465, representing the goods entered and actually weighed at the custom-house, the official weight being 16,880 tons. This makes the average value over £25 per ton, and thus, in some measure, confirms my estimate of the general value of imports before examining into the trade of Ecuador. It is probably excessive to fix the yearly imports of that country at 40,000 tons.

Exports	£1,257,978
To Chili and Peru	121,127
	£1,136,851 =
22,737 tons, at say £50	

For Ecuador, therefore, we have—

Imports	40,000 tons
Exports	22,737 "
Total North Atlantic trade	62,737 "

Colombia

has no trade with the North Atlantic worth mentioning through her Pacific coast ports. Panamá is simply a land transit, not to be taken into account when estimating the interchange of goods between countries. Some canal-tonnage estimates erroneously include the traffic of the Panamá railway.

Costa Rica.

Pacific coast imports and exports (estimated) ... ... 12,000 tons

Nicaragua.

Imports	£703,490
Deduct for Atlantic side	200,000
	£503,490 =
20,100 tons at £25	
Exports	£792,203
Less gold, silver, and Atlantic coast	262,850
	£529,353 =
8822 tons at £60	

For Nicaragua, therefore, we have—

Imports	20,100 tons
Exports	8,822 "
Total North Atlantic trade with Pacific coast ...	28,922 "

Honduras.

The import and export data are confused, but the *Imports* are about—

		£280,803
On Atlantic side	£80,803	
From Pacific coast	1,500	
		82,303
		£198,500 =
8000 tons at £25		
Exports		£231,014
From Atlantic side	£117,743	
Gold and silver	67,484	
		185,227
		£45,787 =
2289 tons at £20		

For Honduras, therefore, we have—

Imports	8000 tons
Exports	2289 „
Total North Atlantic trade with Pacific coast ...	10,289 „

Salvador.

Imports	£600,000 = 24,000 tons at £25
Exports	£914,269 = 30,475 „ £30

This credits all the trade to the North Atlantic, although a proportion is due to the Pacific coast countries.

For Salvador, therefore, we have—

Imports	24,000 tons
Exports	30,475 „
Total North Atlantic trade	54,475 „

Guatemala.

Imports	£900,000 = 36,000 tons at £25
Exports	£1,674,000 = 47,830 „ £35

This also credits the whole trade of Guatemala to the North Atlantic, although it does not belong to it entirely. The value of the coffee of Guatemala exported was £1,478,096.

For Guatemala, therefore, we have—

Imports	36,000 tons
Exports	47,830 „
Total North Atlantic trade	83,830 „

Mexico.

The financial agent in London gives me the latest statistics which he has for the trade of the west coast (Acapulco, Manzanillo, San Blas, Mazatlan, Guaymas, and La Paz) for the year 1896.

Imports	£272,289 = 10,912	tons at	£25
Exports, including silver	£726,393 = 18,160	„	£40

For Mexico, on the west coast, the trade varies but little. It is probably an excess to give—

Imports for 1900	12,000 tons
Exports	20,000 „
Total for North Atlantic trade	32,000 „

Although some of this tonnage is due to California.

California.

	San Francisco imports		£8,128,749
Of this:	120,000 tons cement		197,764
	142,500 „ common goods at £15		2,137,338
	909,300 .. coal		1,406,134
	Balance		4,387,513 =
	115,000 .. high-class trans-continental gooods at £38		
Total	1,286,800 „ total value		£8,128,749
	Total tonnage imports		1,286,800 tons
	Deduct coal from British Columbia...	573,600 tons	
	„ „ Australia	179,800 „	
	„ „ others	52,600 „	
	„ sundry high-class goods	115,000 „	
	„ China and Japan cement	1,800 „	
			922,800 „
	Total for North Atlantic trade		364,000 „

Exports, not including £3,123,954 treasure ...		£7,949,012
Of which to Europe		2,928,606 =
	585,721 tons at £5	
Add	4,758 „ for United States and east coast, all sea-route	
„	73,890 „ *viâ* Panamá	
Total	664,369 „	

For San Francisco, therefore, we have—

Imports	364,000 tons
Exports	664,369 „
Add for San Diego and Los Angeles imports and exports	20,000 „
Total North Atlantic trade by sea	1,048,369 „

Oregon and Washington.

Imports.

At Portland	£531,458
Of this from Pacific countries	461,191
	£70,267 =
7027 tons at £10	
Exports	£1,801,072
Trade with Pacific	548,286
Trade with United Kingdom	£1,252,786 =
313,196 tons at £4	

Imports of *Puget sound* customs district from Europe, say 15,000 tons at £10 = £150,000
Exports to „ 140,465 „ £4 = £561,858

The remaining trade is with Pacific countries. For Oregon and Washington, therefore, we have—

Imports and exports of Portland	320,223 tons
„ „ Puget sound	155,465 „
Total North Atlantic trade by sea	475,688 „

British Columbia.

Import and export trade with North Atlantic *viâ* Cape Horn, estimated 75,000 tons.

Hawaii.

Imports	£3,800,000
From United States west coast	1,831,000
	£1,969,000 =
98,500 tons at £20	
Deduct 13,100 „ Asia and Pacific islands	
Leaves 85,400 „	
Exports	£4,525,000
To west coast of United States	2,320,000
	£2,205,000 =
147,000 tons at £15	

For Hawaii, therefore, we have—

Imports	85,400 tons
Exports	147,000 „
Total for North Atlantic trade	232,400 „

Polynesia.

The imports and exports of the several islands, not including Fiji, are valued at about £265,000. It is probably an excess to allow 20,000

tons for their North Atlantic trade. That of Fiji is almost wholly with Australia.

TRADE OF THE UNITED STATES WITH THE ASIATIC PACIFIC COAST.

Imports.

Japan		£6,544,884
China		5,379,223
Hong Kong		251,251
Asiatic Russia		202
Of this total		£12,175,560
California receives	£4,298,103	
Portland „	88,100	
Puget sound ports receive	1,825,663	
		6,211,866
		£5,963,694

Which amount mostly represents goods of secondary value, say, £25 per ton = 238,547 tons

Exports.

From the United States to—

Japan		£5,817,528
China		3,051,749
Hong Kong		1,697,198
Asiatic Russia		610,050
Chinese Russia		67,462
		£11,243,987
From which deduct for California ...	£2,250,000	
„ „ Portland	419,800	
„ „ Puget sound ports	1,870,000	
		4,539,800
		£6,704,187

Of this amount, take half at the average tonnage value of £40 =	83,800	tons
And half „ „ „ £20 =	167,600	„
Total	251,400	„

For trade of United States with the Asiatic Pacific coast, we therefore have—

Imports	238,547	tons
Exports	251,400	„
Total	489,947	„

for the east coast trade of the United States, all sea-route.

It may be appropriate to call attention here to the hallucination which exists regarding the foreign trade of the people of China, and the anxiety of the Western nations to secure it at any cost, as if dense population were the measure of commercial possibilities. Compare China with its 400,000,000 inhabitants with the Argentine Republic and Chile, aggregating but 8,000,000; China has a total foreign trade

of £69,320,000, and the two other countries £80,556,000. China gives 3s. 6d. per head, and the Argentine and Chile average a trade of £10 per head—the difference between the inertia of old age and the activity of youth.

The Philippine Islands—the last colonial curse of Spain—now transferred to the United States.

Imports from the United States		£270,000
Exports to "		808,000
The former at £20	=	13,500 tons
The latter at £15	=	54,000 "
Total		67,500 "
Deduct for California trade		12,000 "
Leaves for east coast trade of United States ...		55,000 "

The tables of distances do not warrant the supposition that any of the commerce of Europe with Australia and New Zealand can be diverted from the routes it takes at present; therefore our inquiry regarding those countries is confined (as in the case of the Philippine islands) to the trade which the United States has with them.

Trade of Australasia with the United States.

	Imports.	Exports.
New South Wales	£2,557,961	£3,981,242
Victoria	1,323,757	235,012
South Australia	350,860	900
New Zealand	775,309	457,875
Totals	£5,007,887	£4,675,029

Of the *imports*		£5,007,887
New South Wales imports from west coast of United States, say	£300,000	
Victoria (Government Report)	71,485	
South Australia, say	50,000	
New Zealand (Government Report)	87,403	
		508,888
		£4,498,999 =
112,475 tons at £40		
Of the *exports*		£4,675,029
Those from New South Wales include gold	£3,701,156	
And coal to west coast of United States ...	66,094	
		3,767,250
		£907,779 =
22,695 tons at £40		

We therefore have of Australasian trade with the east coast of the United States—

Imports	112,475 tons
Exports	22,695 "
	135,170 "

Summary of tonnage upon which a Panamá canal would have to depend for traffic were the canal open to-day.

	Tons.
Chile	2,050,250
Peru	294,088
Ecuador	62,737
Costa Rica...	12,000
Nicaragua...	28,922
Honduras	10,289
Salvador	54,475
Guatemala	83,830
Mexico	32,000
California	1,048,369
Oregon and Washington	475,688
British Columbia...	75,000
Hawaii	232,400
Polynesia	20,000
Asiatic-Pacific coast	489,947
Philippines	55,000
Australasia	135,170
Total	5,160,165

When we consider that, of the nitrate trade of Chile, 1,057,584 tons are carried by sailing craft, that the exports of the west coast of North America to the United Kingdom are nearly all by sail, and that the remaining countries of the above list have a large trade by sailing ships, it seems reasonable to estimate that at least fifty per cent. of the commercial cargo tonnage indicated is carried by sailing craft. Were there a strait, *without toll charge*, connecting the two oceans at Panamá, would these ships take that route? The evidence regarding sailing conditions is of such a nature that no prudent man would, for the purpose of estimating the value of the projected canal as a commercial venture, take into account the tonnage of sailing ships engaged in the trade of the countries interested in it. Even the "Isthmian Canal Commission" in its report just presented to the United States Government, although it includes the sailing-ship tonnage in its estimate of canal traffic, says: "The Nicaragua route would be the more favourable one for sailing vessels," which, however, "would probably be unable to compete with steamers to any considerable extent by either canal. They would certainly be unable to compete with steamers, both using the Panamá canal." In other words, send your freight by steamship if you wish to use the canal. But suppose you do not wish to use it? The report preserves a discreet silence as to whether the Commission believes that sailing craft can be counted on to use the canal at all.

My estimate of cargo tons upon which a canal would have to depend, carried to-day by sail and steamer, is 5,160,165 tons, from which it seems proper to deduct half for the sail-tonnage, 2,580,082, leaving 2,580,082

cargo tons, to which a canal must look for traffic. But how much of this can the canal count upon with certainty? This is a question that no one can answer even approximately. Although a steamship may find the canal route the shortest possible for her voyage, there is only a hopeful possibility that she will take it, for there are other factors in the problem which may govern her choice of route, so well known to the shipping world that it is not necessary to occupy space in their discussion. For instance, in 1878, the tonnage which passed through the Suez canal was 2,269,678 tons net, while the tonnage then believed to be tributary to the canal was, according to the United States Bureau of Statistics, 6,312,742 tons. Thus the canal got 36 per cent. only from its apparently tributary traffic. But let us be generous to so magnificent an enterprise as an American isthmian canal, and assume that it will get 70 per cent. of the apparent steamer traffic, or 1,806,058 cargo tons. Then comes the question what is a cargo ton in relation to the net register ton of a steamship? the latter being the class of measurement adopted by the Isthmian Canal Commission in its estimate of canal tonnage for purposes of toll. It is well to state that there is a special Suez canal tonnage measurement, on which the company collects its nine francs per ton toll for all ships making the transit of the canal. As this is important, I give it in connection with the tonnage of the following ships, which are average examples of modern freighting steamers:—

Name of ship.	Gross tons.	Net.	Suez tons.	Cargo capacity.
Cheltenham	3741	2415	2756	6000
Shrewsbury	3223	2079	2828	5400
Winchester	3237	2087	2493	5400
Rugby	3286	2110	2854	5400
Charterhouse	3021	1928	2528	4900
Repton	2881	1852	2164	4328
Anglo Chilian	3817	2441	2924	6000
South America	4197	2701	3930	7300
Juanita North	3503	2233	2737	5660
Total	30,906	19,846	25,214	50,388

The average cargo capacity of these steamships is, therefore, about two and a half times their net tonnage; but if the Suez measurement be adopted, it is just twice; but the cargo capacity is dead weight, and includes coal-bunker space. If the cargoes be general measurement goods, the ships will carry more than their full cargo tonnage capacity plus coal. Thus, in estimating the ship tonnage, and including a few ships in ballast or with partial loads, it may fairly be conceded that every net register ton of steamships will carry two cargo tons.

THE RESULT OF THE ANALYSIS is that the portion of existing traffic which a Panamá canal may possibly attract (1,806,058 cargo tons) will require 903,029 net register tons of steamships.

The Isthmian Canal Commission recommends a "net register" toll of $1 per ton; but states that the cost of maintenance of the Panamá canal will be $2,000,000 yearly, and of the Nicaragua, $3,300,000.

Of course, much depends upon the growth of commerce of the countries bordering the Pacific ocean during the ten years' cutting of the canal. That growth may be important, but is it not over estimated? What has it been on the Caribbean sea side of the canal during the past four centuries? When the estimates for the old Panamá Canal Company were made in 1879, the Congress fixed the tonnage at 5,250,000 "très hypothétique," and therefore "prudently reduced" it to 4,838,000 tons; but calculated that upon opening the canal in 1889 the increased commerce of the world would give the canal 7,249,000 tons net register. Thus the same delusive argument prevailed then as now regarding growth of traffic. Thirty years have elapsed since Lesseps held his congress, and now we have the estimate of the Isthmian Canal Commission, giving the canal 4,574,852 tons net register, and stating that the new Panamá Canal Company estimates the tonnage at 4,685,575 tons. What has become of the continuous increment since Lesseps' original estimate?

After an elaborate report of the highest scientific value, which does great honour to the engineering talent of the United States, the Isthmian Canal Commission seems to convey the impression that it would have been thankful if chapter ix. on the "Industrial and Commercial Value of the Canal" had been entrusted to a body of gentlemen less tied to accurate analysis, and a knowledge of the value of words. How keenly it realizes the illusory nature of its tonnage estimate is evident from the following statement in its report:—"The commerce of western South America with Europe will continue to pass the Straits of Magellan, or to round Cape Horn; the trade of the American Atlantic seaboard with Australia will keep to the Good Hope route, and the traffic between our eastern seaboard and the Philippines and southern China will remain tributary to the Suez route if the charges for passing the American canal are made greater than the saving to be effected by using that waterway. A toll of about $1 per ton net register could probably be paid by the commerce between Europe and western South America, and by that of our eastern seaboard with Australia; a much higher charge would probably cause a large share of the business to continue to be done by the routes now used. For the commerce of our eastern ports with the Philippines and the main land of Asia between Singapore and Shanghai, the distance by way of the Suez and Isthmian canals will be so nearly equal that the route will depend largely upon tolls. Light charges at the American canal will give that waterway a

large share of the tonnage; high tolls will cause the Suez route to be used."

The report of the Commission (minus appendix)* only generalizes the traffic estimates, giving 6,702,541 cargo tons. One may be allowed to express surprise that *net tonnage* in 1899 "was ascertained by an examination of the statistics of *entrances* and *clearances* kept by the United States and European countries, and included 336,998 tons for the commerce now crossing the isthmus of Panamá." This *net register* vessel-tonnage for the Panamá railway for 1899 is so widely at variance from 'Poor's Manual,' which gives 287,400 ordinary *gross* tons for that year, that the discrepancy merits attention.

The Commission says that its total traffic estimate "was compared with the investigation made by the New Panamá Canal Company. *The records of vessel movements kept by that company*" (the italics are mine) "show a traffic, for the calendar year 1899, of 3,848,577 tons net register for the commerce between Europe and the Western coast of the American continent, between the Atlantic seaboard of America and trans-Pacific countries, and between the two American seaboards. The total obtained from *the records kept by the Panamá Company* does not include any vessel-tonnage for the commerce now crossing the isthmus. The addition of that tonnage, 336,998 tons, raises the total to 4,185,575."

One gathers, from this statement, that the New Panamá Canal Company has kept a special "*record of vessel movements*" during the year mentioned. But the Commission has been misinformed, or, perhaps, has misinterpreted the information given to it. The Panamá Canal Company informs me that its estimate is derived from "le dépouillement de très nombreux documents de statistique"—abstracts from very numerous statistical documents—which is the procedure which has been adopted in all canal traffic estimates since that made by Lesseps.

Would it not be desirable to have something more definite than the following item in the Report of the Commission: "The entrances and clearances of New Zealand's trade with North-Western Europe amounted to 481,178 tons, net register in 1899, and the European commerce of the other islands east of Australia to 181,743 tons. Of this total traffic of 662,921 tons, 500,000 might have advantageously used an isthmian canal, and this should be added to the canal tonnage originating or terminating in America. This makes the total obtained by the Commission's investigation of the tonnage that might have used an isthmian canal, in 1899, 4,574,852 tons net register; and the total

* I learn that the appendix to the report of the Commission cannot be completed for several months yet. This appears to postpone canal legislation at Washington; for no prudent legislative body, even with the overflowing treasury of the United States behind it, can afford to launch forty to fifty million sterling into Panamá or Nicaragua without a keen analysis *in detail* of the generalized estimates of traffic.

obtained by adopting the New Panamá Canal Company's figures, originating or terminating in America, 4,685,575 tons." It is notable that the estimate of the Canal Company itself is 3,848,577 tons, and that the Commission adds to it the Panamá railway traffic and 500,000 tons, which, in its opinion, north-western Europe may send through the canal in the New Zealand trade. The report absorbs every vessel which, in its voyage, might, on the basis of distance, "have advantageously used the canal." Does the Suez canal, to-day, show a traffic tonnage on the same hypothesis? I sympathize with the Isthmian Canal Commission. Only monastic patience and mathematical talent impervious to offence, can wade through the voluminous, frequently overloaded and often contradictory and erroneous trade statistics of the world, and derive from them any satisfactory result. In the "Preliminary Report" of the Commission, November 30, 1900, I find that, after an exhaustive study of the commerce of the world, it is estimated that it will give the canal net-register tons 5,736,456. The final report reduces this figure to 4,574,882—that is to say, by no less than 1,161,574 tons. It is to be regretted that the estimates are so wavering.

The "Preliminary Report" says, "The statistics of exports and imports of all countries being given in values or quantities, it was necessary to convert these into their tonnage equivalents." Here we are agreed, but why did the Commission abandon this only legitimate basis for an estimate, and resort, in the final report, to the *ignis fatuus* one of "*entrances* and *clearances*" of vessel tonnage?

The most elaborate, voluminous, and careful Isthmian canal traffic estimate, on this basis, which I have seen was that made in 1880, by the United States Bureau of Statistics, under the very intelligent direction of Mr. Joseph Nimmo, jun. Even thus, his "Proposed American Interoceanic Canal in its Commercial Aspects" could find only 1,625,000 tons to credit to the canal from the world's commerce.

For the sake of brevity, I have largely confined my estimate to Panamá, but if Nicaragua be the route adopted, the tonnage conceded must be reduced, because, for most of the general merchandise trade of Chili, it will turn the scales in favour of the Straits of Magellan.

Against the disadvantage of a canal with locks, recommended by the Commission, whether across Nicaragua or Panamá, the depth of water throughout is to be 35 feet. This, taking into consideration the increasing size and draft of ships, will, of course, give an American canal great advantages in competition with Suez for the trade of the Pacific coast of Asia and adjacent islands; but is it supposable that the Suez Canal Company will allow its control of trade to escape for want of dredging? The maximum draft of ships permitted in the canal, since April 15, 1890, is 25 feet 7 inches.

In considering the tonnage which will use an American canal, coal

becomes a factor of importance, and perhaps, in some cases, it is master of geographical position. The best bunker coals are Cardiff, Tyne, Newcastle (in New South Wales), and Pocahontas or New River, shipped at Norfolk and Newport, Virginia. Poorer descriptions are found in India, Japan, and Chile, not at all comparable to those mentioned. The west coast of the United States is supplied with excellent coal from Australia, Wales, British Columbia, Seattle, Tacoma, Mount Diablo, Coos Bay, Tesla, and Rocky mountains.

For Suez canal voyages, the following are approximate prices for annual coaling contracts at Port Said, Colombo, and Singapore, 1897 to 1902:—*

	1897.		1898.		1899.		1900.		1901.		1902.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Port Said, Welsh ...	18	0	20	6	24	6	26	0	29	0	24	0
Colombo, " ...	30	0	27	6	31	0	35	6	45	0	30	0
" Bengal ...	21	0	20	6	22	6	23	0	23	0	20	0
Singapore, Welsh ...	35	0	35	0	32	6	38	0	46	0	37	6
" Japan ...	19	6	26	0	24	0	26	0	27	0	25	0

"With regard to Colombo and Singapore, the largest and fastest steamers take Welsh coal as a rule, but some, at Singapore, take the best description of Japan coal, paying sometimes a shilling or two above the prices given, in order to secure best possible descriptions. Ordinary steamers take Bengal coal at Colombo, and ordinary best Japan at Singapore."

The price of Japanese coal at Hong Kong is 22*s.*; at Shanghai, 20*s.*; and at Yokohama, 19*s.*

The price of coal in Oregon at tide water is about 12*s.* per ton; at Vancouver, 19*s.*; at Esquimalt, 23*s.*; Victoria, 23*s.* At San Francisco, during 1890, the best Australian averaged from 27*s.* to 30*s.*, but the growing output of the mines of British Columbia, Oregon, and California promises, within a few years, to supply the entire wants of the Pacific coast of North America. Coronel (Chile) coal is of very poor quality, and averages about 20*s.* per ton as against 40*s.* for Pocahontas or Welsh. At Honolulu, Australian coal is about 48*s.* per ton, Seattle 40*s.*, and British Columbia, which is of very fine quality, 52*s.* New River steam coal, Virginia, is 13*s.* at Newport News, 28*s.* at Colon, and 38*s.* at Panamá. By these prices the comparative coaling cost of a voyage *viá* Suez or *viá* Panamá may be approximately estimated.

The average speed of a cargo ship is about 9 knots an hour, and the following example of a voyage is interesting:† Steamer *Straits of Menai*, 6200 cargo tons, speed about 9 knots, voyage recently made from United Kingdom to Amoor river, Japan, Puget sound, Coronel, Straits of

* I am indebted to Messrs. Hull, Blyth & Co. for preparing this table for me.

† By the courtesy of Messrs. Mann, George & Co.

Magellan, Cape of Good Hope, Delagoa bay, Cape of Good Hope, Buenos Ayres, and home. Consumption of coal per day was: Scotch, 16 tons 9 cwt.; Welsh, taken abroad, 15 tons 2 cwt.; Japanese, 17 tons 7 cwt.; British Columbia, at Puget sound, 18 tons 9 cwt.; Coronel, 20 tons. The above is a practical demonstration of the relative value of the different coals mentioned, for steam purposes.

My finding of the problematical traffic of an American interoceanic canal is 903,029 tons, net register, on the basis of the world's commercial movement to-day. What is the principal reason that it is problematical?

To answer this pertinent question, an inquiry into the relation which the projected canal will bear to the Pacific railways of the United States and Canada is important. When the $47\frac{1}{2}$ miles of the Panamá railway were opened to traffic, January 28, 1855, there was not so great a length of railway west of the Mississippi river. Now there are seven trans-continental lines which reach the Pacific coast. The first one, the Union and Central Pacific, was, with a divine faith in the solidarity of the country, pressed to completion during the great Civil War, and opened to traffic from New York to San Francisco, May 10, 1869. The first whistle of the locomotive called the trade between the Atlantic and Pacific states to abandon the Panamá and Cape Horn routes, and take the trans-continental one. In 1869, the interchange of trade between New York and San Francisco *viâ* the Panamá railway was valued at £14,040,000. In 1870 it dropped to £3,720,000, and in 1879, by continuous decrease, had fallen to £990,000. These figures include treasure £3,230,000 in 1869, and only £43,300 in the year following. The Panamá railway had evidently lost its control of interoceanic communication; man had discovered how to turn and make of quite secondary value one of the most commanding geographical positions on the globe—one from which, for three centuries, Spain had directed the commercial destinies of two-thirds of the Western Continent and the whole eastern shore of the Pacific ocean. If the effect of the trans-continental railways on the traffic across Panamá was disastrous to the Panamá railway, it was annihilating to that between the Pacific and Atlantic coasts *viâ* the Cape Horn route. In 1869, a magnificent fleet of clipper ships carried on this commerce; they have disappeared! In 1900, the Panamá railway showed a movement of 357,377 tons of freight; not so much as in 1888.

The tonnage transported by the following named Pacific railways for 1900, *according to 'Poor's Manual,' was—*

By the Atchison, Topeka, and Santa Fé	9,893,018
„ Missouri Pacific	11,126,275
„ Northern „	7,121,655
„ Great Northern Pacific	5,162,757
„ Southern Pacific	15,256,989
Total tons	48,560,698

This tonnage, 136 times that of the Panamá railway, includes the local and through traffic which has been called into existence west of the Mississippi river since the Panamá railway was built. To this we may add the traffic of the Canadian Pacific, 7,155,813 tons, over twenty times that of the Panamá line. These avenues of commerce are different from those of ocean-borne trade; they ramify in countless directions; every city, town, and hamlet draws life and vigour from them; thousands of stations along their routes serve as distributing points from which branches lead to minor centres. This vast system of communications may be likened to a fisher's net spread across the continent and from the Gulf of Mexico to Lake Winnipeg, with every mesh teeming with active life and trade possibilities, and interested in the welfare of every other mesh. What a commerce! In comparison to this picture, what is the ship and her ocean avenue? There are no distributing and receiving points for cargo at every mile of her voyage; on the contrary, she is a medium of through traffic only; the ocean waste is not a feeder of her powers, but a severe tax upon them; she leaves a port, and, after many days, reaches another, and all is loss in the interval; as she ploughs her way through the waters, they close in behind her, and are again as they were a million years ago. This is the transportation means upon which our United States Government counts to do battle with the Pacific railways for trans-continental and Pacific ocean trade when an American canal is cut.

When an interoceanic canal began to be seriously discussed in 1870, the people of the United States had not found a satisfactory *modus vivendi* with the railways. Only recently have the interests of both become harmonious, the railways finally bending to the necessities of the country as regards traffic rates. I am indebted to the "Interstate Commerce Commission" for the following traffic rates at present ruling per ton-mile, in comparison to those of 1870:—

	1870.	1900.
Lines east of Chicago	1.61 cents ...	0.55 cents
West and north-west lines	2.61 „ ...	0.89 „
South-west lines	2.95 „ ...	0.91 „
Southern „	2.39 „ ...	0.63 „
Trans-continental lines	4.50 „ ...	0.93 „

These rates are the average for the entire traffic of each set of lines.

The following are the through rates for all classes of goods from San Francisco across the continent:—

CLASS RATES IN CENTS PER 100 LBS.

	1	2	3	4	5	A	B	C	D	E
From San Francisco to New York	370	330	265	210	185	185	165	130	115	105
From San Francisco to New Orleans	320	280	230	185	165	167	148	115	100	90
From San Francisco to Galveston	300	260	220	180	160	160	140	110	95	85

Among certain articles not classified are canned goods, beans, and dried fruits. The rates are the same on these articles from San Francisco to New York, New Orleans, or Galveston—canned goods and beans 75 cents per 100 lbs., and fruit $1. It is thus seen that the railways are already able to carry certain goods across the continent for $16.80 per gross ton. The distances are—

From San Francisco to New York	3267 miles
" " New Orleans	2454 "
" " Galveston	2156 "
" Vancouver to Montreal	2094 "

'Poor's Manual' gives the average receipts per ton-mile for the trunk lines of the United States for 1900 as 0.736 cent—say three-quarters of a cent.

Those of the New York central system (10,387 miles) were	0.56 cents
Norfolk and Western (1554 miles)	0.43 "
Chesapeake and Ohio (1476 miles)	0.34 "
Canadian Pacific (8356 miles)	0.79 "

May we not suppose that as the country west of the Mississippi river is more thickly populated and developed, and local traffic increases, the trans-continental lines will gradually reduce their through-rate tariffs for all low-class freight (the only kind for which an Isthmian canal may possibly compete) to half a cent per ton-mile at most? They do that now for canned goods and beans. This is the crux of the position as to railways *vs.* canal, but only so far as the immediate fringe of the Atlantic coast is concerned. Every ton of Pacific coast goods which may be landed in New York *viâ* an Isthmian canal, and destined for inland consumption, will be handicapped as it moves westward until the total transportation charge exceeds that of the ton crossing eastwards across the continent to meet it; and the same applies to the reverse movement of trade. Two-thirds of the population of the United States are found west of the Appalachian mountain range, and the centre of population of the entire country is in Southern Illinois. It is, therefore, manifestly inadmissible to argue that inland products of the states of California, Oregon, and Washington will be shipped say 100 miles westward to a Pacific port, pay loading charges, freight by steamer, canal toll, insurance, unloading at New York, storage and agency commissions, to again move westward by railway to the interior, when such products can be transported directly and delivered, by undisturbed carload, at the point of demand, be it the smallest town found on any branch line of railway in the United States.

By the courtesy of Mr. Stubbs, Director of Trans-Continental Railway Traffic, I learn (January 2, 1902) that "the average time between San Francisco and New York for freight by rail is twelve to fourteen days; *viâ* Panamá, the schedule time is thirty days."

How far can the Pacific railways compete with a maritime canal

for the trans-Pacific trade? An examination into the recent commercial development of the Pacific coast of the Dominion of Canada and the United States brings surprise after surprise. All the important ports—San Francisco, Portland, Seattle, Port Townsend, Tacoma, and Vancouver—are preparing to share in the trade of the Orient and of all Pacific ocean countries.

Numerous lines of great steamships are entering the field for the trans-Pacific trade, and the "Pacific" railways of North America are evidently determined to control it to a large extent. The Canadian Pacific has a service to Yokohama and Hong Kong, to which they have recently added two large steamships. The "Canadian Royal Mail Steamship Line" has three steamers giving monthly service to Honolulu, Brisbane, and Sydney; the Japanese "Nippon Yusen Kaisha Company," the entrances and clearances for which at Seattle for 1900 reached over 77,000 tons net register, competes with the Canadian Pacific and Dodwell lines for the trade between Japan and the American Pacific coast, with a fine fleet of steamships; the "Great Northern Steamship Company," recently incorporated, is building three steamships, aggregating 33,000 tons capacity, to run in the Seattle-China trade in connection with the Great Northern Pacific Railway; the "Globe Transportation Company," also recently incorporated, is building steamers for the general trade of the Pacific, with headquarters at Seattle; and the "Oregon Railway and Navigation Company" is to have four new steamships for the China-Japan line from Portland, Oregon. "A feature in the shipping trade of the Pacific coast is the advent of the Glen line of steamers; from Tacoma, two steamers have already departed loaded with wheat and other freight for Europe. It intends to maintain regular sailings from Tacoma to London *viâ* Manila, Singapore, Penang, Colombo, Rangoon, the Red sea, Suez canal, Mediterranean, and continental ports. The principal cargo will be wheat for Europe, with general merchandise for the Philippines and the ports south and west of Hong Kong." * The lead of the Glen line is being followed by the "China Mutual Steam Navigation Company" to enter the same trade. Here we have a practical recognition of the great advantages possessed by the Suez canal in the matter of numerous ports along the route of vessels using it. The same consular report says, "There is no doubt the large trans-continental railways are making strenuous efforts to influence the commerce of the Orient, for the benefit of their lines, and eastern railways (not touching the Pacific shore) are continually striving for connections with this trade."

The "American-Hawaiian Steamship Company" is putting on a line of six steamers of large capacity for the San Francisco, Honolulu, and New York trade. The "Oceanic Steamship Company" has recently agreed to make eleven round trips yearly, with 3000-ton steamers,

* British Consular Report, No. 2666, on the trade of Portland, Oregon. 1901.

between San Francisco and Tahiti. The same company has three 6000-ton steamers lately arrived at San Francisco for the trade between that port and Sydney. The "Pacific Mail Steamship Company" is building two vessels of 12,000 tons capacity, each to be added to their fleet operating between San Francisco and Hong Kong, and a line to Manila is under discussion in San Francisco. Five large steamship lines are now running along the west coast from San Francisco to Valparaiso, and in this trade the "Pacific Steam Navigation Company" has recently joined the "Compañia Sud-Americana de Vapores" of Chile with four steamers each. The "Kosmos Steamship Company" (German) operates between San Francisco and Hamburg *viâ* Central and South American ports, and find the trade profitable. Most of the freight taken is landed in Peru or Chile, where the vessels secure cargoes for Europe.

What does all this great commercial preparation portend? There can be but one response, and that is that the west coast of North America recognizes and is determined to utilize its geographical position, facing the Orient, and make its ports the emporia of Oriental trade for the whole of North America, throughout which 200,000 miles of railways will receive it and give exchanges.

The railways have but little respect for the geographical position of Panamá, and seem to shatter the old idea that nature intended that man should make oceans and rivers his principal avenues of commerce; they often force the ship to abandon its old route, while they frequently ignore the largest rivers: they have turned the Mississippi into little other than a great drainage ditch. Through the kindness of the War Department at Washington (December last), I am informed that between Minneapolis (Minnesota) and the mouth of the Missouri river twenty-seven railway bridges cross the Mississippi. Fourteen of them are also provided with wagon roadways. Before railway bridges began to be multiplied across the great stream, volumes were written upon its importance as a commercial artery, and one of the arguments for the preservation of the Union, during our Civil War, was that the North could not allow the mouth of the river, destined to carry to the sea the commerce of the whole interior of the United States, to fall under control of a Southern Confederacy. How much of that commerce do the railways now allow it to carry to the sea? The great central city of Saint Louis seated on its banks will answer the question.* Total goods received in 1890, by rail, 15,375,441, and by river, 512,010 tons; total shipped by rail, 9,180,309, and by river, 245,580 tons. In 1880, the freight on wheat from Saint Louis to Liverpool *viâ* New York by rail was 42 cents per 100 lbs.; but in 1900 it was 19.30 cents, and by river, *viâ* New Orleans and sea, it was 18.41 cents. The grain

* See 'Annual Statement of the Trade and Commerce of Saint Louis for 1900.' Saint Louis, 1901.

shipments by rail to the Atlantic seaboard in 1900 were 6,786,000 bushels, as against 3,414,000 by river and sea route.

Taking commerce, engineering, cost of completion, yearly maintenance, and period of time required for construction, the Panamá canal route appears to offer advantages superior to that of Nicaragua.

This being a study in commercial geography, the military reasons which may exist for cutting an interoceanic canal do not come within my ken. They must be powerful to compensate for the long years of taxation to which the Treasury of the United States will be subjected before a canal can give any return upon the capital involved, not to mention the deficit for a term of years between revenue and cost of maintenance. The Government of the United States, and both political parties, seem, however, committed to the great venture; and, as a preliminary to its realization, have even been willing to engraft the Hay-Pauncefote Treaty upon the old Clayton-Bulwer Convention.

A powerful nation is about to make an effort, on a grand scale, to "side-track" the magnificent trade-avenues created by the private capital and resourceful energies of its own people. It will be interesting to watch the contest between an Isthmian canal and the Autocrat of the continent—the locomotive.

OCEANOGRAPHICAL RESEARCH IN THE ATLANTIC.

By HUGH ROBERT MILL, D.Sc., LL.D.

THERE has recently appeared in the *Philosophical Transactions* of the Royal Society a memoir on the circulation of the surface water of the North Atlantic, by Mr. H. N. Dickson, which constitutes an important contribution to physical geography.* It is published at an opportune moment, when our Government is considering the whole question of international co-operation in carrying out oceanographical work with a view to the improvement of fisheries, and when all the maritime nations of Europe are exerting themselves strenuously in the same direction. We propose to give a summary of Mr. Dickson's paper, necessarily incomplete, for the mass of work it contains is very great, but sufficient, we trust, to show the nature of the problem attacked, the methods employed, and the results obtained.

The introduction contains a statement of Petermann's conclusions arrived at in 1870 with regard to the part played by the Gulf Stream

* "The Circulation of the Surface Waters of the North Atlantic Ocean," by H. N. Dickson, B.Sc. *Philosophical Transactions*, Series A, vol. 196 (1901), pp. 61–203.

in the circulation of the North Atlantic. This may be taken as the last word of the period of unsystematized study, which was superseded by the period of modern research with the improved oceanographical methods elaborated by the *Challenger* and similar expeditions. Petermann recognized that the current of the Gulf Stream and of the polar streams varied both in strength and direction with the seasons, and he urged that special researches on this point should be made. Between 1870 and 1890 many expeditions, equipped by different nations, and sometimes on a large scale, studied the oceanography of the North Atlantic; but they did not seriously take up the seasonal changes in the currents or in the physical conditions of the surface water. The only exception was the compilation of current-charts by the Meteorological Departments, giving the average conditions for the different months. This, however, while making the fact of seasonal change plain enough, did not make it possible to trace the actual process of change from month to month in any particular year or sequence of years.

In 1877 Prof. Ekman made a detailed study of seasonal changes in the Baltic, and he was followed by Prof. Otto Pettersson, to whose untiring efforts the high status of Scandinavian oceanographical research at the present day is largely due. Somewhat similar work was carried on round the coast of Scotland by Sir John Murray and the staff of the Scottish Marine Station. An experiment in international co-operation was made not unsuccessfully by Swedish, Norwegian, Danish, German, and British vessels in 1893 and 1894. Mr. Dickson took part in that work, and his preliminary results, published in the *Geographical Journal* for March, 1896, are familiar to our readers.

Encouraged by these results, he resolved to extend them, and at the same time to treat the subject with greater exactness than had been previously attempted for so wide an area. In order to obtain a sufficient quantity of data, it was necessary to confine the observations to the surface water only, and to adapt them to the exigencies of unscientific collectors on vessels whose ordinary route and routine could not be altered for any scientific purpose. The region selected for study was the Atlantic ocean north of 40° N., and arrangements were made with the Meteorological Office by which it was found possible to obtain a transcript of the sea-temperature observations from the meteorological logs of a large number of British ships. Additional data were obtained from some of the similar institutions in foreign countries, and a good many were sent in direct by captains who had become interested in the work. For the sake of uniformity, all temperature readings were reduced to the same scale, and the Centigrade was adopted, as the interval of 1° C. was found a convenient one at which to draw sea-surface isotherms. A number of observers took the additional trouble of collecting samples of surface water in bottles supplied in boxes of

thirty, and sent, on the return of the ship, direct to Mr. Dickson in Oxford for chemical examination.

The samples of water when received were used for the measurement of salinity by means of titration with silver nitrate to determine the amount of halogen present. The work was done with all necessary precautions, and was more than sufficiently accurate for the purpose of charting differences in salinity. We believe, however, that both Mr. Dickson and Prof. Pettersson underestimate the accuracy and the utility of the hydrometer for determining salinity by means of observations of density. Such instruments as Mr. J. Y. Buchanan's absolute hydrometer, or the total-immersion hydrometers more recently brought to perfection, yield results as good as can be demanded of any method for distributional purposes. When time permits and the expense of the method of titration is no objection, we should prefer to employ both processes, so that one set of determinations might be a check upon the other. The quantity of water placed at Mr. Dickson's disposal put the use of the Buchanan hydrometer, which is a somewhat bulky instrument, out of the question; and, as we have said, the salinities in this memoir are thoroughly accurate. For the purpose of establishing ratios, Mr. Dickson determined a number of densities by means of the laborious and difficult, though extremely exact, method of weighing pyknometer tubes filled alternately with distilled water and the sea-water under examination. The interest of the results is physical rather than oceanographical, and so need not be further referred to here. The sulphates in some samples were determined—a useful measurement, as the variation in the ratio of sulphates to chlorides is one of the best tests of difference in place of origin of sea-water.

Having described and exemplified his methods, Mr. Dickson goes on to discuss the distribution of temperature and salinity for each month of 1896 and 1897, and gives a map showing the salinity and another showing the temperature of the surface water of the North Atlantic for each month of the two years. These maps are beautifully reproduced in colour by Bartholomew, and distinctly show the seasonal variations of the conditions.

The final section of the memoir is a discussion of the movements of the surface water based upon the observations shown in the maps. It is the most interesting part of the work, and we summarize the results as stated without subjecting them to any further criticism than a general examination of the charts. These appear to bear out fully all the conclusions that Mr. Dickson has drawn from them, and they definitely prove that it is possible to keep under continuous observation the larger surface changes of the North Atlantic, as a whole, without the equipment of special expeditions, and at small expense. We earnestly hope that the Marine Department of the Meteorological Office will continue and extend these observations, which have a sufficiently

direct bearing on the meteorology and surface movements of the sea to bring them fully within its scope.

The first difficulty in the discussion is to distinguish between seasonal change in the water at a given spot, and translational change due to the intrusion of water of different origin on the surface, or of water from a greater depth raised to the surface. It would take too much space to go fully into this question here; but, allowing for all uncertainties, we may adopt with confidence the conclusions which Mr. Dickson sums up—

"The surface circulation in the North Atlantic, between the parallels of 40° and 60° N., forms, during winter, part of a cyclonic movement, resulting in a southerly and south-easterly drift on the western side, and a northerly drift on the eastern side. In the lower latitudes, about 40° N., the easterly movement is comparatively weak. The northerly movement in the eastern half of the area is considerable, but it is hampered by the configuration of the land; . . . hence the water tends to spread widely over the surface northward and north-westward, but stream currents of any marked degree of energy are not developed. Hence there is a tendency at the end of winter towards uniform distribution of salinity and temperature which is aided by a diminution in the supplies of polar water.

"In spring the north and south components become less marked, and the easterly movement becomes stronger everywhere south of lat. 50° N., the increase being most noticeable in the lower latitudes. The greater angle now made by the drift with the European coast-line causes increased 'banking up' of water against the land, and this water escapes by stream-currents running northward and southward. . . . The northward discharge of Atlantic water from the lower latitudes is therefore greater during the months of spring and summer, when a stream-current, independent of the local surface drift, sets northward between Scotland and Iceland. . . . As the summer progresses the drift circulation in the higher latitudes becomes weaker, but after midsummer the increased strength of the current from the south is replied to by an enormous delivery of polar water—first and chiefly from the area between the east and north-east of Iceland and Jan Mayen, then later, as the ice breaks up, from the polar current east of Greenland. The Labrador Current also increases largely in volume, but a greater proportion of this increase is likely to be due to melting of ice by the warm air sent up by the cyclonic circulation developed over the continent of North America. . . .

"If it be admitted that the surface circulation undergoes the periodic changes described, it appears that they follow directly from the seasonal changes in the circulation of the atmosphere at the surface, modified by the position and form of the land. . . .

"The general circulation of the North Atlantic is therefore the

result of a large number of factors, each of which is subject to wide variation. From a consideration of the mean result in its relation to the mean atmospheric circulation, it appears that the oceanic circulation is directly controlled by the winds, the form, position, and intensity of the whole of the Atlantic anticyclone, and of the cyclonic area to the north of it being taken into account. The movements of water set up directly by these systems are modified by, firstly and chiefly, the configuration of the land, and, secondly, by the effects of melting of ice."

These results indicate the great importance of ascertaining the exact relations which hold good between atmospheric and oceanic movements, a subject to the elucidation of which Mr. Dickson proposes to devote a subsequent paper. Enough has been done by him in the present memoir, and by Profs. Pettersson and Meinardus, to whom he refers, to show that the variations of atmospheric pressure, by determining the system of winds, dominate the relative strengths of the various ocean currents, which in turn directly affect the climate. The problem is ripe for further study, and promises important practical bearings.

Reference may be appropriately made, when dealing with Mr. Dickson's work, to the latest publication of Prof. Pettersson and his compatriots, although it takes for its province, not the North Atlantic only, but the whole of that ocean.* The work was carried out during 1898 and 1899, and as a result charts are given showing the distribution of salinity, temperature, and plankton in the surface water for certain months or groups of months: a word of praise must be given to the ingenious way in which the maps are arranged, although they are drawn on a somewhat intractable projection from the point of view of space required for printing. The Swedish investigators consider that temperature observations without salinities are of very little value, and they give greater weight to the distribution of plankton as a key to oceanic circulation than oceanographers in this country are likely to accept. The matter is one of those on which we have undoubtedly much to learn, and Prof. Cleve is a very competent and enthusiastic teacher. We may recall the fact that *plankton* is the general name applied to the small organisms which drift with the water. They are of many species, and some of them are not only very clearly marked and readily recognized, but are typical of certain localities in the ocean, or at least of water possessing certain physical characteristics. For example, organisms of one type are characteristic of tropical water, those of another type are characteristic of polar water, and according to the relative abundance of these two types in a given sample it is believed to be possible to estimate the relative proportion of tropical and

* 'Les Variations annuelles de l'eau de surface de l'Océan Atlantique.' Par P. T. Cleve, G. Ekman, O. Pettersson. Göteborg. 1901.

polar water in the mixture. This is a very simple case, but by recognizing types characteristic of minor differences in origin, and accepting the theory that where these organisms are found they must have been carried by the water in which they float, systems of quite elaborate circulation may be deduced from the contents of a series of tow-nets. In fact, the minute crustaceans and protozoans of the sea are looked upon from this point of view as mere multitudes of drift-floats, each species marked with its own place of origin. This method of research appeals to the imagination, and when biologists have definitely ascertained the physical conditions of which each type is characteristic, the oceanographer will have gained an instrument of research of vast importance. The happy combination of biological, physical, and chemical knowledge in the Swedish triumvirate who sign this memoir has certainly proved that the new method is one of important possibilities.

The result of the study of variations in salinity and plankton for the period considered is the recognition of three elements concerned in producing the surface circulation of the Atlantic. These are given as—

(1) A flow of Atlantic water towards the northern hemisphere in spring along the eastern shores of the ocean, actuated by a force which seems to originate in the antarctic seas.

(2) An extension of the Gulf Stream towards the European seas in autumn.

(3) A flow of arctic water from the neighbourhood of Greenland and America towards Europe in winter, as a consequence of the melting of the ice in the polar current, which affects the opposite shores in that season.

One thing that is established by these researches is the unity of the ocean, and the consequent necessity of investigating all parts of it simultaneously and systematically, were it only in order to direct intelligently the fisheries off our own coasts.

Occasional and spasmodic efforts have been tried and found wanting. The work that is now required is of the thorough and persevering type pursued by Mr. Dickson and the Scandinavian investigators, but with the ampler means and assured continuity that Government funds and international co-operation can alone command, and with observations made, not at the surface only, but at all depths in the water. If special vessels devoted to scientific work were provided for the North Sea and the margin of the Atlantic, their results, combined with surface observations over the breadth of the ocean, would tell us all that it is necessary to know in order to complete our knowledge of the circulation of the seas affecting Europe.

REVIEWS.

ASIA.

THE GEOGRAPHY OF THE GRÆCO-PERSIAN WARS.*

MR. GRUNDY is one of those historians who consider that the serious treatment of the physical phenomena of a country is a necessary and important element in history. After nearly a year spent in learning the principles and practice of surveying, he visited Greece in 1892–93, as the Oxford Travelling Student of the Royal Geographical Society, surveyed Platæa and Leuctra, and examined the western passes of the Kithæron range, and the roads leading to them from Attica. In 1895, and again in 1899, he was enabled, by grants from Brazenose College, to revisit Greece, and on these occasions he was able to complete his examination of the roads and passes utilized by the Greek and Persian troops; to examine the field of Marathon, the Euripus, and the Strait of Salamis; and to make detailed surveys of Pylos, Sphakteria, and the pass of Thermopylæ. The surveys were carried out within the limits of Oxford vacations, and consequently at high pressure, either in winter, when snow and mud make movement from point to point difficult and sometimes impossible, or in summer under a burning sun, when malaria is rampant, and even deadly, at such places as Pylos and Thermopylæ. Mr. Grundy was fortunate in escaping with an attack of ophthalmia, which is as prevalent at Thermopylæ to-day as it appears to have been in the days when Leonidas held the pass.

Mr. Grundy shows a good grasp of the geographical and topographical features of the theatre of war, and a just appreciation of their military importance. The great influence of sea-power, first in the hands of the Persians, and then of the Greeks, upon the course of events is well brought out; and attention is frequently drawn to the important part which physical features played in the general conduct of the war, and in the actual conflicts on the field of battle. The author is, I believe, the only recent historian of the "Great War" who has taken the pains to prepare himself for his work by a systematic study of the country in which it was fought, and who has written with such full knowledge of the localities made memorable by the victories and heroism of the Greeks. The results are some excellent maps and plans, and a series of geographical and topographical discussions which, resting as they do on personal knowledge, are of great value. They confirm the general accuracy of Herodotus when he describes the topographical features of places which he actually visited, and throw light on many details of the military operations which were previously obscure.

It is difficult to select any portion of the geographical work for special comment, but attention may be drawn to the descriptions of the passes in the Kithæron-Parnes range, of the battlefields of Marathon, Thermopylæ, including the detailed account of the "Path of the Anopæa," and Platæa, and of the physical features which had such an important influence on the conduct of the naval operations in the Euripus and the Strait of Salamis. The discussions are illustrated by well-selected photographs, and copies of several of Mr. Edward Lear's watercolour sketches of Greece. The papers on Platæa and Leuctra by Mr. Grundy, published in 'R.G.S. Extra Volumes,' 1894, were full of promise, and the present volume is an ample justification, if any were needed, of the policy adopted by the Society, of encouraging the scientific study of geography at the Universities.

* 'The Great Persian War and its Preliminaries.' By G. B. Grundy, M.A. John Murray. London, 1901.

The above notice has been confined to the geographical and topographical information, as to the value of which there can be no doubt. The whole work bears evidence of great labour and research; but it would have been more acceptable to the general reader if it had been less drawn out, or if its contents had been differently arranged. The continuity of the ever-fascinating story of the "Great War" is frequently broken by discussions of motives and possibilities, which, interesting as they are, must be necessarily inconclusive, and might have been relegated with advantage to Appendices or Supplementary Notes. In some instances the discussions have led to repetition, and in others they appear to be of unnecessary length. Many of the conclusions will meet with general acceptance; and the only regret is that, in discussing questions of this class in the body of the book, Mr. Grundy has to some extent obscured the grandeur of the story. The criticisms on "the war as a whole," and on "Herodotus as the historian of the Great War," in the last two chapters are much to the point, and will repay careful perusal. Mr. Grundy's work is one of unquestionable value, and it is satisfactory to know that he proposes to deal with the period after 470 B.C. in a separate volume.

C. W. W.

AFRICA.

The Ophir Question.*

In attempting to solve once for all this much-debated question, Prof. Keane does not bring forward many new facts or decidedly novel theories, but his task has been rather to take up the threads of the controversy and weave them into such a connected whole as may present a solution convincing from the harmony of its several parts. In the problem as a whole there are two main questions, which have often been treated as one, but which the author shows with much force to be quite possibly distinct—that of the original source of the gold of Ophir, and that of the locality of Ophir itself.

We must be content here to state the general conclusions arrived at by Prof. Keane, referring our readers to the book itself for the detailed argument. The gold-producing country he holds to have been without doubt Rhodesia, pointing out both the vast extent of the old mining operations and the existence in the country of most of the products associated with the gold of Ophir in the Bible story. A strong point in favour of this view (the correctness of which has become more and more probable with every fresh antiquarian discovery) is the consideration that, owing to the absence of commodities to give in exchange for the gold, the merchants must have been forced to employ slave labour to procure it, which would have hardly been possible in a populous and politically organized country such as India. Rhodesia, however, was not Ophir, which is shown with much reason to have been, not the producing country, but the great emporium whence the gold and other commodities were distributed. This (after rejecting all other theories) Prof. Keane finds, with Ritter, in Southern Arabia, where all the elements necessary for successful identification are present. Here, in the district of Dhofar, explored by Bent during his last journey, is still an ancient Himyaritic population, agreeing with the statements in Genesis, which connect Ophir with the Joktanides. Here, as shown by Ritter, was "Sephar, a mount of the East," by which the habitat of Joktan's sons was limited. Here, too, was the port of Moscha (the Mesha of Genesis), still neighboured by ancient ruins—the Portus Nobilis of

* 'The Gold of Ophir, Whence brought, and by Whom?' By Prof. A. H. Keane. London: Stanford. 1901.

Arrian, known to have been once a great emporium. And lastly, here, in the Sapphara of Pliny and Ptolemy, shown by Glaser to represent Ṫafar (Saphar or Aphar), we have the actual name Ophir, which is to be translated "metropolis," the city of cities, just as its port was the port *par excellence* of the Eastern trade. Hither were brought the mineral riches of South Africa, the peacocks of India and Ceylon, the spices of the surrounding regions, to be eventually laden on the navies of Solomon and Hiram.

In these main conclusions we imagine that Prof. Keane will carry with him the majority of his readers, but in some points of detail he is on less firm ground. Thus the gold land of Havilah he identifies as Rhodesia, and Tharshish as its port (Sofala or Beira ?), mainly from the difficulty of finding elsewhere an adequate source of gold-supply, and the association of the names Havilah and Ophir in Genesis, as if both concerned in the same trade. Certain questions suggest themselves in this connection. Why, it may be asked, should Solomon's ships have made the long voyage to Tharshish if gold was to be had at Ophir? Why does the name Havilah not occur in connection with this trade? How is the association of Havilah with Sheba—certainly in Arabia—to be explained? If Tharshish is merely the port of Havilah (a country without political organization), should we expect to hear of "the *Kings* of Tharshish and the Isles"? Did Solomon and Hiram, or only the Himyarites, employ the slave-labour at the mines? and if the latter, how were they paid by the former? Why do we hear of peacocks as brought by the ships of Tharshish, not by ships of Ophir?

Some at least of these difficulties would be obviated by the simple supposition that Tharshish = Moscha, and was thus itself the port of Ophir, the two names being used generically by Phœnicians and Himyarites respectively as the designation of a great emporium of trade, so that the one would be virtually a translation of the other. A Tharshish in Arabia would suit well with the passage in Psalm lxxii., the second half of the verse being in this case, in accordance with the genius of Hebrew poetry, a sort of echo of the first; and also with the passages of Ezekiel, in which Tharshish, as Ophir elsewhere, is referred to in terms implying it to be a great commercial centre, rather than an outlying port.

The latter part of the book sketches the history and enterprises of the Himyarites, especially in Rhodesia. Into this we need not enter, as the subject is partly covered by Messrs. Hall and Neal's recent work, of which it is proposed shortly to give an independent notice. E. H.

POLAR.

Dr. von Neumayer and Antarctic Research.

Prof. Georg von Neumayer has collected into a substantial volume* the numerous contributions which he has made from time to time during the last fifty years to the cause of antarctic exploration. His insistent advocacy of every branch of scientific investigation at sea, and especially towards the poles, is too well known, and has been too highly appreciated in this country, to make it necessary at this period to give a critical summary of the contents of the book before us. Dr. von Neumayer has pursued his aim unfalteringly for half a century, and the generous manner in which he brought the weight of his great influence to bear on the promotion of the British Antarctic Expedition in its early stages will

* 'Auf zum Südpol! 45 Jahre Wirkung zur Förderung der Erforschung der Südpolar-Region, 1855–1900.' Von Prof. Georg von Neumayer. Berlin; Vita Deutsches Verlagshaus. 1901.

not easily be forgotten. If the name of a cherished locality is ever engraved by the earnest thought of years upon a human heart, Dr. von Neumayer's is marked broad with the word *Südpol*. It is useful to have in a collected form these various papers of different date, but the volume has a warmer interest for geographers than even the centre of the frigid zone can kindle. It reveals something of the personal history of an honoured friend and master, an unexpected side-light of autobiography, reflecting the glow of an ardent and adventurous youth on the placidity of a singularly gracious age. The beauty of the photograph of the Director of the Deutsche Seewarte as he is to-day—though the picture has an air of sternness foreign to our memory of the man—will convince even a stranger that the artist's pencil did not flatter the young sailor of half a century ago. These two portraits of themselves make the book worth possessing.

Piecing together the hints in the preface, the introductions to the different memoirs, and the episodes alluded to in abstracts of the earlier lectures, we can trace the origin and growth of Dr. von Neumayer's passion for the south pole; and the task leaves us full of regret that the autobiographical framework is so narrow. Still, what there is of it is welcome, for it shows us a German, enthusiastic in his patriotism beyond the majority of his countrymen, yet unswerving in his loyalty to the great republic of science where all nations are as one.

On taking his degree in 1849, Georg Neumayer's mind was full of the exploring voyages of Ross, Wilkes, and Dumont D'Urville, and the scientific deductions of Gauss and Sabine. Resolved to pursue his studies in terrestrial magnetism and in the science of the ocean, and not without the ambition of aiding a united Germany to arise and grow into a maritime power, he made a voyage to the east coast of South America in a Hamburg ship in order to acquire a practical knowledge of nautical astronomy and navigation. On his return he passed his examination as mate, and spent several months in the effort to obtain a post in the Austrian navy, Austria being then the most powerful maritime state of the German Confederation. Failing in this, he gave a series of lectures in Hamburg on Maury's theories of the ocean and on the recent improvements in the science of navigation; and since he could find no other way of gratifying his craving to see the southern hemisphere, he shipped as a common sailor and landed at Port Jackson in Australia in 1852. Two years were spent in the Australian colonies, part of the time as golddigger at Bendigo, and, when the digging was unfortunate, as a lecturer on navigation in a tent on the goldfields, where an audience of disappointed sailors could easily be brought together. In 1854 he returned to Europe on a sailing ship with a mutinous crew, and he came back resolved to leave no stone unturned to get up a voyage of scientific exploration towards the south pole, or a journey into the then unknown interior of Australia.

He was fortunate in making the acquaintance of Alexander von Humboldt, Dove the meteorologist, and the great chemist Liebig. King Maximilian II. of Bavaria, an enlightened patron of science, who consulted Liebig as his chief scientific counsellor, considered a memorial drawn up by Neumayer on the important results bearing on antarctic research which would accrue from the study of terrestrial magnetism at Melbourne, and granted the funds for establishing the well-known Flagstaff Observatory. In August, 1856, before leaving for Melbourne, Neumayer laid his plans for a physical observatory before the British Association at Cheltenham, and received the approval of Whewell, Airy, and Faraday.

While carrying on the magnetic and meteorological observations at the Flagstaff Observatory, and collecting on Maury's plan all possible data as to the navigation of the Southern Ocean, Dr. Neumayer took a prominent part on the committee which directed the exploration of the interior of Australia; but in 1862

he once more returned to his favourite subject of antarctic exploration. In a farewell address to his countrymen at Melbourne as he was leaving for Europe, he said—

"It would be a glorious moment in the next period of my career if I could seek the antarctic regions in a German ship, and perhaps sometime you will see me return to these shores accompanied by the pick of the youth of all German races, bound on a voyage to the south pole."

So far did the coming of the *Gauss* cast its shadow before; though none of the young Germans now in the antarctic ice were born at that time, nor was the united German Empire, which made such a national enterprise possible, then in sight.

Dr. Neumayer always urged the practical side of antarctic research; he showed how it would increase the certainty of navigation, and how it would stimulate the spirit of maritime enterprise which, from his student days, he had recognized as an indispensable element of national greatness. Thus he took as the theme of his first serious appeal on returning to his fatherland, at Frankfort in 1865, the importance of antarctic exploration and the necessity for the foundation of a central institution for the systematic study of oceanography and marine meteorology. The latter suggestion was acted on in a liberal spirit, and in his direction of the Deutsche Seewarte at Hamburg, Dr. von Neumayer has fulfilled his life-work and placed his country in possession of an oceanographical institution of which Maury himself would have been proud, and which is the admiration, if not the envy, of the oceanographers of other countries. Not only has it proved of inestimable practical value to the seafarer, but it has afforded training to a number of scientific men whose names, already well known, are destined to occupy a high place amongst the students of nature.

How nearly the other design was accomplished also has probably been forgotten by most of our readers. Dr. Neumayer suggested that an expedition for antarctic research should be fitted out as a preliminary to the Transit of Venus expedition in 1874. The Vienna Academy of Sciences took the matter up cordially on the advice of Admiral Tegetthoff, and Dr. Neumayer was promised the command of an expedition to set out from Hamburg towards the end of 1870. The outbreak of the Franco-Prussian war and the birth of the German Empire interrupted the expedition; but Admiral Tegetthoff revived it in the following year, and all was going well when the sudden death of the admiral brought the plan to an untimely end; so Austria-Hungary lost the honour of renewing south polar research, and Dr. Neumayer the opportunity for becoming an explorer.

We need not enumerate Dr. von Neumayer's further efforts to revive interest in the subject in his own country and amongst the geographers of the world. He strove at the meetings of the International Geographical Congresses (especially at London in 1895), at successive gatherings of the German "Geographentag," at other assemblies of men of science in many countries; and at last he saw the naval flag of his country flying over an expedition commanded by a man of science, while his sympathies were scarcely less heartily extended to the British National Expedition, which started almost simultaneously with a plan of complete international co-operation in the cause of science. Dr. von Neumayer acknowledges that he has not been able to give effect to all his wishes with regard to antarctic exploration, and he states, with an emphasis for which we should have thought there ought to be no necessity, that his efforts have always been solely for the advancement of science and the good of his country. H. R. M.

OCEANOGRAPHY.

Miss Giberne on the 'Mighty Deep.'*

This book "attempts to cull a certain number of leading facts from the great storehouse of knowledge, and to put them in order, for the many who love sea-breezes and ocean waves, and who may like to know a little more about the friend whom they so often visit." The author has consulted a considerable number of books and papers on oceanography, and gives, on the whole, a fairly accurate account of some of the results of recent research, although without the first-hand critical knowledge essential in selecting for a book of the kind. The chief defect of the book is that it attempts to explain too much, and describes too little, and this is accentuated by the facts that there are only nine illustrations and no diagrams.

GENERAL.

Sergi on the Mediterranean Race.†

Prof. Sergi's 'Stirpe Mediterranea' appeared in 1895, and was revised for a German translation two years later. Now appears in English a more thorough revision, taking account of recent criticism up to about the beginning of 1900. This limit may be deduced from the final chapter, evidently printed off before Mr. A. J. Evans's great discovery of Cretan tablets had become known. Among recent English works bearing on his subject, Prof. Sergi takes especial account of Keane's 'Man Past and Present' and Ripley's 'Races of Europe;' and also of the archæological results arrived at by Messrs. Evans, Petrie, and Ohnefalsch-Richter, in Crete, Egypt, and Cyprus respectively.

After five years Prof. Sergi does not see reason to modify any of his main craniological conclusions. And, indeed, his demonstration of the existence of a pre-Aryan population and civilization in the Neolithic Age over much of North Africa, all South and West Europe, and part of Western Asia has been very generally accepted, at least as a working hypothesis. The absolute identity of that race everywhere and of the civilization over so wide an area has raised more doubt, but, broadly stated, seems to prove not less acceptable. The original derivation of this "Eurafrican" stock from the African Lake Land, however, remains no more than a suggestion. Prof. Sergi adds no fresh documentary evidence to the very little he adduced in 1895. For general credence to be given to his theory concerning the character of the Aryan invaders of Europe he has still to wait. Apart from all pro-Aryan prejudice, it is hard to believe that the "Eurasiatic" peoples, whose linguistic system contained such potentiality that (as the author admits) it overwhelmed the Eurafrican system wherever issue was joined, were utter barbarians, who had to learn all their culture from the non-Aryan population.

The author's primary documents are, of course, skulls. These he treats as a master, but on a system not universally accepted by craniologists. In view of the great fluidity of this kind of scientific investigation, an impartial handbook on methods of craniology is urgently needed at the present juncture; and this should be written by a first-rate anatomist or pathologist, qualified to show from his own

* 'The Mighty Deep and what we know of it.' By Agnes Giberne. C. Arthur Pearson, Ltd. 1902.

† "The Mediterranean Race: a Study of the Origin of European Peoples." By G. Sergi. Pp. xii., 320. 93 Illustrations. (Contemporary Science Series.) London: Walter Scott. 1901.

point of view why certain modifications in skull-form should be persistent, how far they really indicate race, what they imply as to racial character, and how far the conditions under which they occur exclude other forms. We confess to certain doubts of the empirical methods and the deductions of all craniologists based on their kaleidoscopic disagreements and their selectiveness. Exceptions to their classifications seem too often to be put on one side as "pathological;" and they do not satisfy us that skull modification always implies variety of race. For instance, the modern Greeks of Asia Minor (where there has been no Slav or Albanian inroad) are now at the top of the short-skulled class; the ancient Greeks in the same region were, apparently, near the bottom of the long-skulled. Has there been any change of race, or can this skull-modification come about independently of such change? Or does length of skull matter at all?

Prof. Sergi uses archæological evidence as secondary, but gives it great prominence. His views on the racial basis of primitive Mediterranean civilization were "in the air" before he wrote; and few archæologists now question the pre-Aryan character of early culture in a part, at any rate, of the area, pending the decipherment of the Knossian tablets, and the definite ascription of Etruscan, Lycian, and Hittite to a family of tongues. Archæology, however, is not the author's subject at first hand, and his acquaintance with its evidence is not comprehensive enough for him to pronounce on such questions as the original seat of Mycenæan civilization. He does not seem to know the "pre-Mycenæan" Ægean, and the all-important ceramic evidence gained there. His confident ascription of the Lemnian inscription to Pelasgo-Tyrrhenians would be more valuable if he showed knowledge of other uninterpreted inscriptions in the Ægean, *e.g.* the Præsian stone, or the Lycian texts, and of the difficulties in regard to the application of the name Pelasgi to any very definite or comprehensive race. We doubt if he is up to date about the "Hittites" and the distribution of "Hittite" monuments; and he proves so much from tomb-forms and burial methods, that nearly all the population of both hemispheres might be Eurafrican.

D. G. H.

Guide-Books.*

Messrs. Macmillan, who have exceptional opportunities for gauging the needs of cultivated tourists from both sides of the Atlantic, have recognized that new guide-books, and not merely revised editions of old ones, written originally when all conditions of travel and taste were vastly different from now, must be provided; and that, moreover, in a cheaper and more portable form for the English-speaking world, which is not wholly satisfied with anglicized versions of guides, first written, however admirably, by and for persons whose habits and tastes are not its own.

In different ways all the four guides quoted above go far to satisfy this demand. No. 1 covers the ground of Murray's 'Mediterranean,' ii.; No. 2 comprehends, at the same price, the scope of Murray's 'Mediterranean,' i., and also his 'Constantinople, Brusa, and the Troad;' No. 3 puts Egypt and Palestine into one very handy volume of about 250 pages at no greater cost; and No. 4, at one shilling more, includes all Italy, but runs to nearly 500 pages. In applauding the aims of Messrs. Macmillan, we would urge them to realize this even more fully in subsequent editions, and to consider seriously whether certain kinds of information remain in sufficient demand among guide-book users to justify the further retention of certain sections. For instance, in Italy, or in any country where the railway

* Macmillan's Guides: (1) Western Mediterranean: (2) Eastern Mediterranean; (3) Palestine and Egypt; (4) Italy. London: Macmillan & Co. 1901.

system is highly developed, is there any use in devoting a section to "Routes"? The railway guides and the railway maps nowadays suffice to determine the destination, and the locomotive does the rest. Trains go too fast for a mere brief description of the views right and left from the track to be in much request. Such a section in an Italian guide seems to us, in fact, to be a needless survival of the old posting days, and by its excision in this case the book would be lightened by forty-seven pages. We hope, further, that the publishers will put a narrow limit to advertisement matter, or that may become as serious an incubus to the public as in the *Continental Bradshaw*.

Again, does the kind of tourist who would read with any profit Mr. Fry's admirable, but very general, notes on Italian art prefixed to this guide, naturally look to a guide-book for such information at all? Our experience is that he does not. Art handbooks are now legion, as are also school histories. In the editor's place we should consider very seriously if historical and artistic introductions are worth more than the saving in bulk and cost involved in the excision of over seventy pages. The same consideration might be extended to the Egypt guide, though the saving in that case would be far less. The plan of departing from geographical order in the case of Italian places of interest, and arranging them as in a dictionary, is excellent; and the notes therein seem as admirably concise as the hotel information is up to date and the maps are clear. In the latter connection we would offer one hint. Railways are the one thing needful to modern tourists, and their lines should blaze out on all tourist maps. On many of Messrs. Macmillan's maps they do shine in vermilion, but on many they do not, *e.g.* on the map prefixed to the 'Eastern Mediterranean,' which errs further in including a great deal to which the text has no reference, and thereby obscuring what is really essential for the tourist.

We note with much approval that a considerable change has been made in the method of dealing with sights and places of interest. The notices no longer read like the recollections of an intelligent traveller returned and describing what he had seen, but are definite directions to a new-comer arrived on an unfamiliar spot. Such a one wants to know what lies to right, left, and before; where he will get to if he takes a certain path; how to reach places, and how to understand what he sees therein. There is still room for improvement, more especially where no good previous guide has formed a basis, *e.g.* in the cases of Crete and Cyprus. In these two great islands, both, for different reasons, singularly interesting to Englishmen, the new guide shows not only no improvement on, but marked inferiority to, the guide-books written a dozen years or more ago. Almost no indication is supplied of their points of interest, and none of how these points are to be reached.

Conciseness cannot be carried too far in guide-books. It must be pushed even to a sort of Tachygraphy of style, and signs and symbols should be freely used to save repetitions and space. Whether the Baedeker asterisk should or should not be adopted, opinions will always differ. We do not advocate the introduction of the unadulterated "drill-book" system of guide writing, or of wholesale "personal conducting," but confess that we have often found discriminating marks very welcome in large galleries and on extensive sites. Few, we fancy, would complain of Mr. Fry's asterisks, if Messrs. Macmillan confided the Italian selection to him, and the great majority of tourists would certainly breathe sighs of relief on submitting to his guidance. The very few who have genuine views of their own will always supplement their guide-book with other manuals, and therefore they need hardly be considered in this matter.

If Messrs. Macmillan push their own ideas of method to their logical conclusion, and take a leaf out of Baedeker's book in such matters as rewriting at short

intervals, sending special emissaries to observe and describe, according to a rigid scheme, and under the direction of a rigid editor-in-chief, we have little fear for the success of their new venture either in Great Britain or in America.

D. G. H.

EDUCATION.*

As Mr. Redway remarks in his preface, "this book is intended to set forth in an elementary manner the relations between human activities and geographic environment," and in spite of a good deal that has been written during recent years to illustrate the intimate nature of these relations, he has, unfortunately, only too good reasons for supposing that this method of regarding geography is new to many teachers of the subject.

In the opening chapters an interesting outline is given of the historical development of geographical ideas. Though several countries around the Eastern Mediterranean were early civilized, Greece may be regarded as the birthplace of geography, for it was here that geographical knowledge was first systematically formulated by Herodotus and other writers. Mr. Redway attributes the rapid development of Greek power and ideals partly to the configuration of the country, and partly to the influence of events resulting from the siege of Troy. In fact, throughout this historical sketch his main object is not only to show how powerfully geographical forces have controlled the life of various peoples, but the important events that have therefore resulted from any disturbance of the physical environment. Probably the best example of the effects of such a disturbance is seen in the wonderful discoveries that resulted from the Turkish blockade of the trade communication between Europe and the East just at the moment when, on account of the reports of Marco Polo and other travellers, Europe had formed exaggerated ideas of the wealth of those parts. Thwarted in one direction, men turned to seek new routes to the Indies, and this search led Vasco da Gama round the Cape of Good Hope to India, caused Columbus to be the accidental discoverer of new lands in the West, started Magellan on the famous voyage that ended in the first circumnavigation of the world, and stimulated men to penetrate even the frozen Arctic regions in hopes of finding north-west and north-east passages to their goal; in fact, in Mr. Redway's opinion, it gave us a New World and regenerated the Old.

In the third chapter some account is given of the evolution of land-forms, stress being laid on the modern view of the changing nature of physical phenomena, as opposed to the old idea of their fixity. This is followed by a description of the effects of climate and topography on the distribution of life and on commercial development, with special reference to the economic history of the United States, while the latter part of the book is devoted to discussion on methods of teaching geography and the use of apparatus. Several useful suggestions are given with reference to observational and field work, which are rightly regarded as forming an essential part of geographical education, and the special preparation of the teacher demanded by the new conception of geography is well set forth.

Though the book may be too sketchy to aid students specializing in any particular branch of geography, it is certainly one that should be welcomed by teachers of the subject as at once stimulating, suggestive, and of general practical utility.

J. B. R.

* 'The New Basis of Geography.' A Manual for the Preparation of the Teacher. By J. W. Redway. Published by the Macmillan Co. 1901.

THE MONTHLY RECORD.

EUROPE.

The Survey of British Lakes.—Sir John Murray has nearly completed his arrangements for beginning the work of investigating the lakes of Great Britain and Ireland, which he has undertaken in conjunction with Mr. Laurence Pullar. He intends to begin with the lochs of Perthshire, some of which he had already surveyed with the assistance of the late Mr. Fred. Pullar. Sir John Murray will take up his residence for a time in the Loch Rannoch region. Sir Robert Menzies has very kindly placed Rannoch Lodge at Sir John's service, and in other ways has shown himself desirous of doing all he can to give facilities for the work. Let us hope that other proprietors will follow Sir Robert Menzies' excellent example.

The Lower Pechora.—In the year 1901, M. A. N. Novosiltsof was sent to the Pechora with the party of Captain Sergieyef to execute surveys and take meteorological observations. From Archangel he travelled to Ust-Tsylma, at the confluence of the rivers Pizhma and Tsylma with the Pechora. This town is the centre of the Pechora district, covering an area of 109,390 square miles, and containing a population of 33,371. About 6000 persons live in the town itself by boat-building, fishing, to a small extent by agriculture and reindeer-grazing, and to a much larger extent by carrying goods and trading. After receiving the Pizhma and Tsylma, the Pechora has a breadth of fully 1¼ mile. North of Ust-Tsylma the population is settled on the river-bank, and eastwards there are no settlements as far as the Ob, more than 450 miles distant. Both banks are clothed with coniferous woods, rarely interrupted by foliage trees. Building timber is found in general only up to the parallel of 67°. Five miles above Pustozersk the Pechora divides into a multitude of channels, most of them fairly deep, but containing shallows useful as fords, but serious obstacles to navigation. Beside the river are many swamps and lakes, some of which run parallel to the bed for several miles without any connection with it. Chief of these is the large Pustoye Ozero, on the western side of which stands the village of Pustozersk upon a sandy mound. It contains about 180 persons, who make a comfortable living by fishing and trading with the Samoyeds. Across the lake is the village Ustye, very similar in appearance, and 25 miles to the south Velikovisochnoye, which trades with the Malozemelskaya tundra and Kolguyef, as Pustozersk and the villages north of it do with the Bolshezemelskaya tundra. Some of the Pustozersk traders go even as far as Obdorsk. In winter the mouth of the Pechora is completely deserted, while in summer people come down on barges from Cherdyn, in the Perm government, bringing corn and other goods to exchange for fish and the products of the chase. Just at the mouth of the river in the Bay of Pechora is the Bolvanskaya bay, on the east side. The shores are high near the Bolvanski cape, and in the middle of the bay a number of hills stand near the shore. Huts are erected here for the white grampus fishery. North of the bay are situated a row of sandy islands called the Guliayevy Koshky, which are placed on maps a mile too far towards the west, and 9 miles too far north. Gwyniad is caught here in summer and sold to Cherdyn traders. The work of surveying was commenced in the beginning of May at the Konstantinovski cape, where it was found that there was no tide, the ice, 4 to 7 feet in thickness, lying perfectly quiet. The ice in the bay broke up on May 28, and was piled up by the tide along the shore. On June 24 and 25 the rise of the tide was 2¾ feet, but on the 28th no tide was perceptible. The shores of the bay are rising and constantly contracting the water area. Near Cape Cherni Lopatka three strand-lines may be seen—a high bank 5 miles from the water; a second a few yards in height, receding sometimes

as much as a mile from the water; and the present shore, exposed for a long distance at low tide. Quantities of wood are cast ashore, and, especially at high tides, are carried far inland. A dozen miles below Konstantinovski cape a small range, the Pitkof Kamen, runs parallel to the coast and rises to a maximum height of 595 feet. In spring the Samoyeds, coming northwards after winter, visit the slopes of the Pitkof to save their reindeer from the horse-flies and gnats. By the Pogancheska bay also, and beyond, opposite Varandei island, runs a range, the Enei, a summer residence of Samoyeds, people of Pustozersk and others, engaged in reindeer-breeding. They also hunt seals and birds, especially in spring, when the nights are light and the weather not too cold.—*Izviestiya* of the Russ. Geogr. Soc., No. 2, 1901.

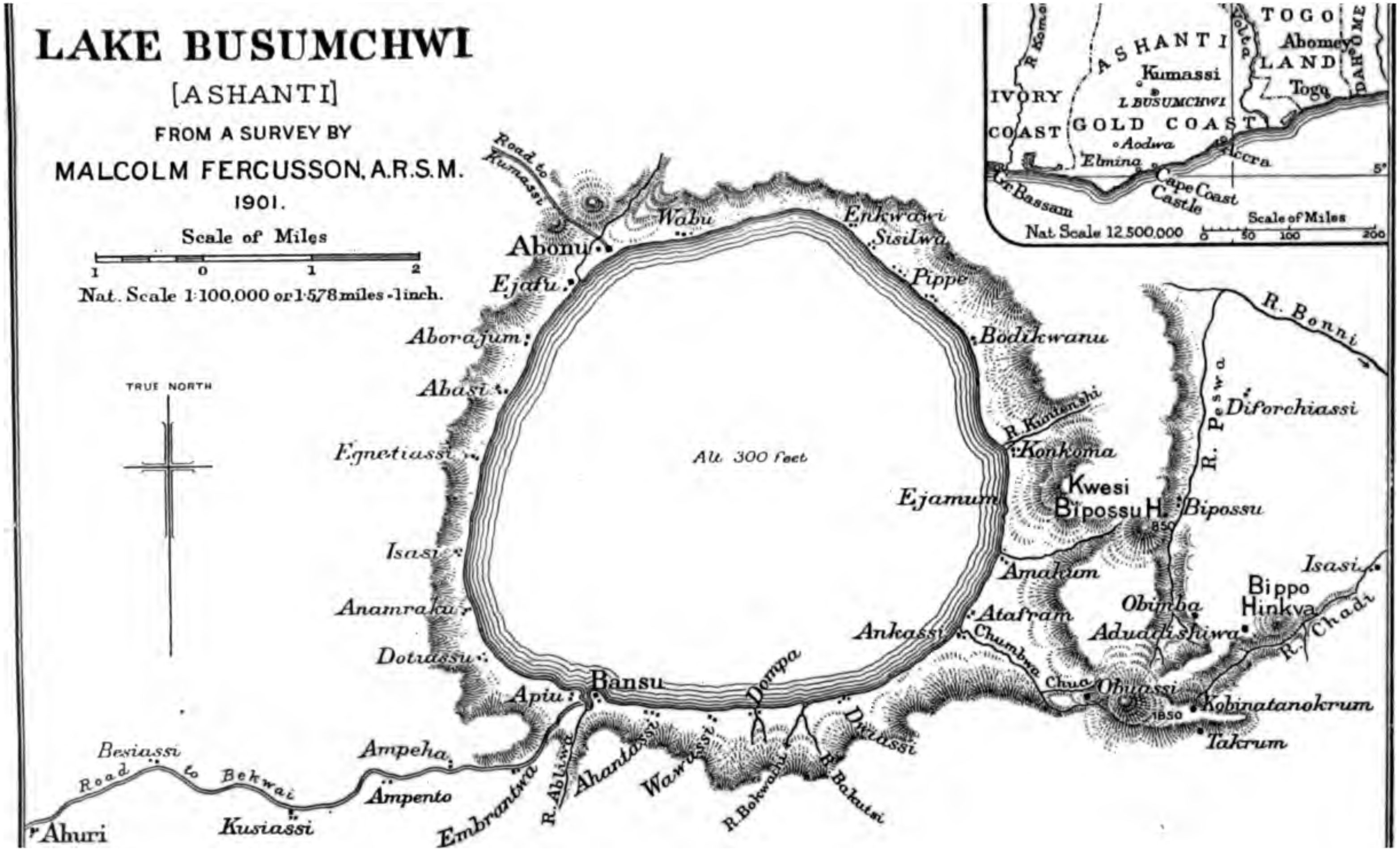
ASIA.

Austrian Expedition to Southern Arabia.—We learn from the *Deutsche Rundschau für Geographie* that an expedition to Southern Arabia for purposes of scientific research has been undertaken by Dr. Hein, of the Vienna Natural History Museum, who is accompanied by his wife. Mahalla will be the first place to be visited, and attention will be paid both to ethnological and linguistic research and to natural history collections.

Ignatov's Exploration of Lake Telezkoie, Altai.—A short account of the results of Ignatov's expedition to Lake Telezkoie, or Altyn Kol, in the Altai despatched early last summer by the Imperial Russian Geographical Society (*Journal*, vol. xviii. p. 212), appears in No. 2 of *Globus* for the present year. The lake (of a visit to which a graphic description was given by Atkinson in his 'Oriental and Western Siberia') lies in a narrow valley at an elevation of 520 metres (1700 feet) above the sea, and has a length of 48 miles, with a breadth varying from 350 yards to 3½ miles, the widest part being in the south. The main portion of the lake runs north and south, the Chulishman river entering at the southern end, while the Biya, which makes its exit at the north-west, joins the Katun to form the upper Ob. The mountains rise precipitously on all sides, clothed with cedars, silver firs, larches, etc., and the rocks consist of much tilted clay-slates and limestones, with some granite and conglomerate. Tectonic causes have evidently contributed to the origin of the lake. The result of 2500 soundings is to show that it is shallow in its northern east-to-west section, but reaches a depth of over 1000 feet in the south. There are two deep basins, separated by a submarine ridge, over which, however, the depth is still as much as 870 feet. In a remote future the lake may be cut up into several separate parts by the encroaching deltas of streams. In the middle of June, the temperature of the water remains at 39° Fahr. at the surface, and 37½° in its lower layers, while that of the inflowing streams is already from 48° to 57°. About the middle of July, however, the surface temperature rises to from 53½° to 61°. The shallow portion freezes over in November; the deep southern part is rarely frozen—perhaps once in seven years. The water is very transparent, a white disk being visible at depths of 30 to 46 feet, as compared with one of 20 feet in the Lake of Geneva in summer.

AFRICA.

Lake Busumchwi, Ashanti. Mr. Malcolm Fergusson, the surveyor who accompanied Mr. J. E. Moore on his expedition to the Central African lakes, sends us an account of Lake Busumchwi, Busumkwi, or Busunetki, as the name is variously rendered by the dwellers in its neighbourhood, together with an outline-map based on his survey, of which a reduction is given herewith. The lake, which lies about 25 miles south-east of Kumasi, is the sacred lake of the Ashantis, the


LAKE BUSUMCHWI
[ASHANTI]
FROM A SURVEY BY
MALCOLM FERCUSSON, A.R.S.M.
1901.
Scale of Miles
1 0 1 2
Nat. Scale 1:100,000 or 1·578 miles - 1 inch.
TRUE NORTH
Alt. 300 feet
Road to Kumassi
Abonu
Wabu
Ejafu
Enkwawi
Sisilwa
Pippe
Aborajum
Bodikwanu
Abasi
R. Kumenshi
Egnetiassi
Konkoma
Kwesi
Bipossu H.
Bipossu
Ejamum
850
R. Peswa
Diforchiassi
R. Bonni
Isasi
Amakum
Anamraku
Atafram
Ankassi
Chumbwa
Chua
Obimba
Aduadishiwa
Bippo
Hinkva
R. Chadi
Dotiassu
Bansu
Apiu
Dompa
Obuassi
1850
Kobinatanokrum
Takrum
Duiassi
Ahantassi
Wawassi
R. Bokwadu
R. Bakutsi
R. Abliwa
Embrantwa
Ampeha
Ampento
Besiassi
Road to Bekwai
Kusiassi
Ahuri
TOGO LAND
Abomey
DAHOME
Togo
Volta
ASHANTI
Kumassi
L. BUSUMCHWI
IVORY COAST
GOLD COAST
Aodwa
Elmina
Accra
Cape Coast Castle
Gr. Bassam
R. Komoe
5°
Nat. Scale 12,500,000
Scale of Miles
0 50 100 200

word "busum" meaning sacred or fetish. It is nearly circular, with a maximum diameter of about 6 miles, and has been on this account erroneously described as a crater-lake, the geological formation—chiefly talcose and quartz schists with intrusive bosses of granite—showing no signs of volcanic action. It lies in a large basin entirely enclosed by hills with an average altitude of 800 feet, that of the lake itself being but 300. The hills are clothed with forest which descends to the shore in places, but has been mostly cleared for plantations near the water. Owing to its sacred character, boats have not hitherto been allowed on the lake, and its depth has not been ascertained, but all appearances point to one nowhere exceeding 20 feet, the shores having a very gradual slope. There are several inflowing streams discharging the drainage of the surrounding hills, which exceeds the amount lost by evaporation, so that the level is just now rapidly rising, as is evidenced by the trees standing in the water, those at a distance from the shore being now dead. Since February, 1900, a rise of 18 inches seems to have taken place. No breeze reaches the lake, and the temperature of the air is stifling, occasionally proving unbearable even to the natives. The water is slightly brackish and extremely fishy in taste, and as the natives, who are much subject to leprosy and other skin diseases, make use of it extensively for bathing and washing clothes, it is hardly safe even to wash in the water unless boiled. The lake teems with fish, which are, however, not easily caught with a baited hook. The natives, whose great industry is fishing, catch the fish by means of huge wickerwork baskets open at the ends, which are woven from the split stems of a kind of lily. When fishing, they paddle themselves about with their hands, seated on dried logs of the cottonwood tree, which they manage with great dexterity. People come from all parts to trade for the fish, bringing plantains, yams, etc., for the fisher-folk, who carry on no cultivation. In Prempeh's time all but the king's own fishermen were excluded, but now there are twenty-five villages around the lake, with a total population of near 10,000. The people were dispersed during the war, and, till lately, were very shy, but have now settled down, and seem a peaceable and quiet lot, lazy as a rule, but generally honest, and extremely honourable in their dealings. Mr. Fergusson speaks in high terms of the Ashantis generally, who are, he says, far and away the best natives of the whole coast, partly owing to the absence of "civilization," but principally to the excellent administration, the people knowing that they can always get justice at Kumasi. The Fantis and Krepis are, on the contrary, described as, each in their way, thorough blackguards. Animal and bird life is scarce round the lake, and even mosquitoes are comparatively few. Monkeys, leopards, a few bush antelopes and pigs, pelicans and kingfishers, the osprey and hawk, are the principal kinds represented. Sandflies are troublesome, but they come out in force only in the early morning and evening. The natives suffer much from fever, but not of a malignant type.

Ancient Gem-workings in Manika.—Mr. A. Vaughan Williams sends us a description of two visits to the neighbourhood of the Chimanimani pass, south of Umtali, in the course of which he paid some attention to the traces of ancient workings for precious stones which seem to have been carried on at a remote period in this district. The pass is a magnificent gorge in the range which separates the territory of the South Africa Company from that of the Portuguese "Mozambique Company," and which rises rapidly from the plains, 3000 feet or more, to an altitude of about 8000 feet. The plains are very fertile, covered with bush and rank tall grass, harbouring buffalo and other game, while the mountain slopes are densely wooded with trees of excellent timber, and well watered with streams, which often form cascades with a sheer fall of 200 feet and more. The ancient workings, of which only the shafts and galleries now remain, there being

no traces of ancient towns or buildings, are situated on the summit of the range, at the headwaters of the Umvumvumba and Manyinga rivers, in a sandstone formation composed of horizontal strata, with veins of quartzite, mica and talc schist, and dykes of diorite. Most of the excavations are in British territory, but some extend across the frontier into the sphere of the Mozambique Company. At the time of his first visit, in 1890, Mr. Williams heard reports of the occurrence of diamonds in the neighbourhood, but regarded them as a romance on the part of natives who had worked in the Kimberley mines. In 1900, however, the report of a discovery of diamonds being again current, he paid a visit to the spot of which he had heard in 1890, and found it to be the place of the supposed discovery. The surface was dotted for miles with fallen-in shafts, which Mr. Williams was at first disposed to attribute to the action of water, the heavy rainfall being absorbed by the porous soil and conveyed underground to the edge

THE UMVUMVUMBA RIVER, MANIKA.

of the plateau along the flat surface of the sandstone. Afterwards he became convinced that such was not the case, as in many instances the "dumps" were plainly visible. The rock specimens collected included crystals of octahedron shape (not diamonds) and other stones, which on examination have proved to be topaz of different colours—a gem well known to the ancients. The features of the native chiefs of the district are said to indicate Arab descent. This discovery certainly seems to confirm the belief that South-East Africa was the quarter whence the gold and precious stones of ancient times were largely procured, though in the case of the gems the argument is less fully supported, owing to the other sources of supply known to the ancients. Mr. Williams speaks enthusiastically both of the climate and the scenic beauties of the country. For eight months in the year the air is sharp and bracing, while before the time of the grass fires a marvellous panorama is spread out before the eye from such summits as

Myamatumba, whence the view extends for a distance of 150 miles. The many waterfalls leaping over the almost continuous line of precipice into the tropical forest below, form a marked element of beauty in the scene. In the summer the short grass of the mountain-tops is enlivened with a profusion of ground orchids, while the forests teem with beautiful varieties of ferns, tree-orchids, climbers, etc. Mosquitoes flourish even at the higher levels, but it is difficult to say whether malaria is endemic, Mr. Williams and his party, which included Mrs. Williams, being already subject to chronic malarial fever. The opinion is, however, expressed that the district will become the sanatorium, as it certainly is the Switzerland, of Rhodesia.

The Capital of Madagascar.—Some diversity of opinion has been elicited by the reported pronouncement of General Gallieni in favour of the virtual removal of the capital of Madagascar from the interior of the island to the coast, which has been unfavourably commented on by those whose interests lie in the direction of the development of Tananarivo. The governor-general has declared it to be his mature opinion that the whole economic future of the island lies in the coast-lands, and that places like Tamatave and Majunga will be called upon to play a *rôle* of increasing importance in this connection in the future. No official action appears to have been taken in the direction of a formal transference of the centre of authority, and Tananarivo will doubtless always remain an important political and military centre, even though the commercial capital may be placed elsewhere.

Journey of a Native Caravan through Somaliland.—A German missionary at Lamu gives, in *Petermanns Mitteilungen* (1902, No. 1), an account of a journey made by a Somali caravan through the little-known interior north of the Tana river. The leader was a Somali who had been in government service, and now applies his savings from time to time to journeys of this kind. Having got together a party, he set out from Kismayu, and, after a wide circuit through the Galla countries along the Abyssinian frontier, finally reached the Rendile country lately traversed by Count Wickenburg (*ante*, p. 216). According to his accounts, the primitive inhabitants of the country are the Wakore, the Rendile (the only Somalis who have not adopted Islam) having been pushed inland by their Mohammedan neighbours. They are said to have expressed a desire for the advent of Europeans. The return journey was made by Kenya, Uganda, and the railway to Mombasa.

Railways in the Stanley Falls Region.—The *Mouvement Géographique* for December 29 last gives a sketch of the proposed route of the more northerly of the two lines of railway which are to be built in the eastern part of the Congo State—that from Stanleyville, just below the Stanley falls, to the Albert Nyanza at Mahagi. Surveys for the line are being executed by a staff of engineers under M. Adam, who has already been some time in the country, and is to remain at work another two years. The proposed route runs at first south of the Chopo river, but crosses this beyond the post of Bafwaboli, and, continuing in a direction slightly north of east, crosses the upper Lindi and strikes the Aruwimi-Ituri near the junction of the Ibina, its southern upper branch. It then follows the south bank of the Ituri and strikes east to Kavalli, then following the crest of the watershed between the Ituri and Lake Albert, until it finally descends the escarpment to reach the lake at Mahagi. A large part of the line will run through the great forest, and the clearance of a track through this will be a work of much labour. For the transport of materials and supplies, it will be necessary to add to the flotilla on the middle Congo. A more recent number of the *Mouvement* (February 2, 1902) gives details of a proposed line for the purpose of turning the Stanley falls and supplying communication between the navigable sections of the river above

and below. This, it is said, will probably be the first scheme to be carried out. Provisional tracings of the route have been made both on the east and west banks of the river, that on the west giving decidedly the shorter mileage. The alternative lines are shown in a map in the number last quoted.

The Position of Insalah.—Reference has already been made (*Journal*, vol. xi. p. 667; vol. xii. p. 412) to the position of Insalah, as given by early and recent travellers, and we are now able to give the result of M. Flamand's observations for the determination of the position. In a note in the *Comptes Rendus* of the Paris Academy of Sciences (vol. cxxxiv. p. 27), he states that on his last journey in the regions of Tademait and Tidikelt (October, 1899–February, 1900) he was able to devote himself to the determination of the geographical positions of the principal points of his route, and particularly to that of Insalah. The determination of the latitude which he made at Insalah was based on six series of circum-meridian observations of the sun taken with a sextant reading to 10″, the mean of the values obtained being 27° 10′ 46″ lat. N. The longitude was determined in two different manners: (1) by means of occultation by the moon of star 65 Belier on January 10, 1900; (2) by observations of the hour angle of the sun with the sextant, from January 6 to 16, 1900, the rate of the chronometer having been deduced from telegraphic comparisons made with the Algiers Observatory, at Tugurt, and Wargla on the outward journey, and at El Golea on the return. The results are as follows:—

	Longitude. In arc.	Longitude. In time.	
By occultation of 65 Belier	2° 27′ 30″	$0^h\ 9^m\ 50^s$	E. of Greenwich.
By observation of hour angle of the sun ...	2° 28′ 0″	$0^h\ 9^m\ 52^s$	

This shows that the result obtained in 1898 from the surveys of MM. Germain and Laperrine (2° 26′ E.) was fairly correct. The co-ordinates of five other places are also given.

M. Doutté's Journeys in Morocco.—With the support of the French Minister of Public Instruction, the Government of Algeria, the Comité de l'Afrique Française, and the Paris Geographical Society, M. Edmond Doutté last year carried out extensive journeys in Morocco, the preliminary results of which are given in a supplement in the *Bulletin* of the Comité above mentioned (1901, No. 8). M. Doutté traversed in various directions most of the western portion of the kingdom from Tangier to Mogador and the Atlas, and though topographical surveys formed no part of the programme which he had set himself, he devoted considerable attention to the physical features of the country and the varying conditions as regards fertility, vegetation, habitability, and so forth. Geological researches had to be kept in the background, firstly because the time was already occupied with other work, and secondly owing to the suspicion likely to be aroused among the inhabitants by them. Some geological specimens were, however, collected in the Atlas region, and have been submitted to an expert. The resources of the country and their possibilities of development formed a special object of inquiry. As regards the fertility of the soil, of which so much has been said by some writers, M. Doutté considers their views exaggerated, although the plains lying in front of the Atlas in the west are certainly rich. With the doubtful exception of the "argan" tree (order *Sapotaceæ*), from the seeds of which oil is extracted, he considers the agricultural products to be limited to those of Algeria and Tunis. The chief source of wealth to a European power would be, he thinks, apart from unforeseen discoveries, the rearing of cattle and sheep, especially the former. As regards mineral wealth, he is again inclined to take a sober view by reason of difficulties in the way of its exploitation, which the example of Algeria renders it

advisable to take into account. M. Doutté's report also discusses the ethnology of the country, its methods of administration, and other allied subjects. He considers that the policy pursued by Europe in the endeavour to lead Morocco into the paths of civilization, must be one of prudence and friendship. Any attempt to interfere directly with the administration must be avoided, but the people must rather be gradually led towards reform through the development of their wonderful commercial aptitudes, the improvement of agricultural methods, the introduction of simple industries, and the initiation of public works.

Surveys in Africa.—The secretary of the British South Africa Company points out to us that in the small map of Africa which illustrates Sir Thomas Holdich's paper in the *Geographical Journal* for December, all reference to the geodetic survey of Rhodesia has been omitted, although the survey has been in progress since 1897. The omission was purely accidental, as will be apparent to those of our readers who have followed the accounts of the progress of the survey given from time to time in the Monthly Record from the reports of Sir David Gill, the astronomer at the Cape (see *Journal*, vol. x. p. 441; vol. xiv. p. 667; vol. xvi. p. 474; vol. xix. p. 90). The first season (1897) was devoted to reconnaissance, while in 1898 the longitude of Bulawayo was fixed by telegraph signals, and a base-line measured on the water-parting to the east. In 1899 the triangulation was extended northward to Gwelo, progress being also made with the cadastral survey; and in 1900 a new base-line was measured and angles determined at fourteen new stations. With reference to the same map, Major Nathan, governor of the Gold Coast, points out that "the northern boundary of the colony on the 11th parallel should have been shown as already surveyed and demarcated; the telegraph line is from Accra to Cape Coast, and thence to Kumasi, and not from Accra to Kumasi direct; there is also a telegraph line from Cape Coast to Elmina, and thence to halfway between Elmina and Assini, which is now being extended to meet the French line at Assini." The boundaries on other sides are now being surveyed, and a general survey is being carried out, based on traverse lines of the gold-mining district on the west of the colony.

AMERICA.

Physical Geography of Central Ontario.—An elaborate paper on the Geological History of Central Ontario appears in the *Transactions of the Canadian Institute* for August, 1901. The writer, Mr. A. W. G. Wilson, traces the various modifications of surface from the ancient pre-sedimentary floor to the recent period following on the retreat of the Pleistocene ice-sheet. It is, however, only with the processes to which the present surface features are attributable that we are here concerned. Previous to the Pleistocene epoch the rocks had been, for a long interval following the last period of deposition, exposed to atmospheric agencies, which developed a topographic system whose remnants, though partly modified by the ice-sheets and obscured by glacial deposits, are still recognizable. The present features are therefore a product of the operation of two processes, Pliocene and early Pleistocene sub-aërial erosion, and Pleistocene erosion by sheet-glacier ice. In its main topographic features Central Ontario is a lowland bounded by the escarpment-fronts of two "cuestas," and occupied by Lake Ontario and the Georgian bay of Lake Huron with the adjacent land-areas. To the south the cuesta-front runs south of the lake from east of Rochester to Hamilton, thence northward to the Manitoulin islands. The northern cuesta is formed by the Black river strata, and its front runs from near Kingston north-west to Georgian bay, beneath whose waters it still seems to be traceable in the direction of the Manitoulins, the unsubmerged portion being generally about 90 feet high. A ridge of drift-deposits divides

Central Ontario into two drainage slopes, a northern and a southern. The main features of the region are those of an ancient coastal plain, which has passed through a period of planation, followed by one of uplift, dissection, and the development of an adjusted drainage system. After describing certain special features, including a series of rock valleys in the east, and the gorges and valleys of the southern or Niagara cuesta, the writer sums up the recent history as follows. While the ice-sheet was retreating across Ontario, a series of lakes were formed between its front and the highlands to the south and west, covering, in the latter stages, portions of the present land area in Central Ontario. The land was being elevated towards the north-east, so that the old shores are not now parallel to the surface of the existing lakes. Since the withdrawal of the lakes the amount of erosion has been small. The courses of the present streams are in part determined by the valleys of the pre-glacial rivers, in part by the position assumed by the drift-deposits with respect to the retreating ice-sheets, and in part to the control exercised by the Pleistocene lake beach-deposits. Many of the present streams do not by any means fit the valleys in which they flow.

New West Indian Lines.—Two new lines of steamers are announced between the United States and the West Indies. The Kerr Line vessels sail monthly from Halifax, N.S., for Jamaica, carrying passengers and cargo, and on their return from Jamaica carry fruit to New York. The United States Steamship Company, with a fleet of fourteen vessels and having their headquarters at Boston, run to Havana and Porto Rico, connecting with inter-insular steamers of the same line for the other islands, and thence proceeding to Central and South America. This is the first direct line between Boston and the West Indian and South American ports.

AUSTRALASIA AND OCEANIC ISLANDS.

Prof. Gregory's Expedition to Lake Eyre.—Prof. J. W. Gregory has undertaken a scientific expedition to the Lake Eyre basin in South Australia for the purpose of investigating its geological history, and, if possible, throwing light on the native traditions of the former existence of giant animals in that region. The leader is accompanied by Mr. H. J. Grayson and five students of the Geological Department of Melbourne University. Prof. Gregory has been temporarily placed at the head of the Geological Survey of Victoria, with a view to its thorough reorganization.

Cardinal Moran and the Discovery of Australia.—The novel theory started by Cardinal Moran a year or two ago, that the continent of Australia was reached by the celebrated navigator Quiros in 1606, still excites interest among geographical circles in that country, and continues to be warmly debated. We have received a paper, presented on May last to the R.G.S. of Australasia, in which the cardinal endeavours to answer the objections of his critics, without, however, adducing any new arguments of importance in support of his hypothesis. His main argument is still based on the enthusiastic descriptions given by the navigator himself when endeavouring to set forth the value of his discovery, and on the fact that a Spanish ship with a brass cannon made in 1596 appears to have been wrecked at some time or other at Port Curtis, in the Gladstone district of Queensland. The detailed refutation of the theory may be left to the various writers in Australia who have taken up the defence of the orthodox view, and two points only need be alluded to as indicating the insecure nature of the grounds on which the new theory rests. When sailing from the bay of St. Philip and St. James in the land "del Espiritu Santo," after the departure of Quiros, Torres first coasted along the shores of the newly discovered land; then he held a south-west course until a certain latitude was reached, *without gaining sight of land;*

and finally turned north-north-west, by which course New Guinea was in time reached. This fits in perfectly with the supposition that the bay of St. Philip and St. James was in the island of Santo, but is, of course, utterly at variance with the idea that the starting-point was on the coast of Queensland. Yet Cardinal Moran considers that "all this fits in very well with the supposition that we have made regarding Port Gladstone." In order to reach this result, he has to make the gratuitous assumption (which still removes only part of the difficulty) that before sailing south-west, Torres "stood out for the open sea" from some point near the New South Wales frontier. The second point above referred to is the fact that in the manuscript map by Don Diego de Prado (one of Quiros' officers), reproduced by Mr. Collingridge in his 'Discovery of Australia,' we have a drawing of the Bay of St. Philip and St. James, which both in orientation and topographical details shows the closest agreement with the bay on the north side of Santo, as drawn in the latest charts. This should surely be sufficient in itself to settle the question.

Agricultural Capabilities of the Northern Territory, South Australia.—In a paper recently read before the South Australian Branch of the Geographical Society of Australasia, Mr. M. W. Holtze discusses the agricultural capabilities of the northern territory and its consequent fitness for permanent settlement. He endeavours to show that, although a large part of the country is utterly unfit for cultivation, there is yet sufficient suitable land for agricultural purposes to make the country prosperous. In the author's opinion the agricultural land in the northern territory is situated near the sea-coast and on the banks of the rivers flowing to the sea. Plantations should be kept within a belt of some 80 miles wide round the coast, which would give an area of about 80,000 square miles. The rainfall of the coastal parts of the northern territory is shown to closely resemble that of French Cochin China, and the soil and climate appear to be in every way suitable for the cultivation of rice. Other products that might be successfully grown in the northern districts are—sugar, coffee, tobacco, coconuts, indiarubber, jute, ramie, arrowroot, tapioca, sesamseed, and peanuts, besides maize and the usual food and fodder plants and fruits of the tropics. In order that plantations in the northern territory may be a success in the future, the author urges the necessity of a careful selection of soil, sufficiency of capital, and suitable labour.

Minerals in West Australia.—While the total output of minerals for 1899 in this state exceeded all previous records, that of 1900, according to the report of the Department of Mines, shows a decrease from the previous year of £167,906, or about 2·6 per cent. This falling off appears to be confined to lead and gold. The decrease in gold has not been general, however, and the return of 1,580,950 ozs. for 1900 has already been nearly equalled by that for the first ten months of 1901. The yield of coal is increasing, and although there are only three producing collieries, with a total output of about 120,000 tons, information obtained as to the existence of new coal-seams is highly satisfactory. The progress of tin-mining is disappointing, only 823 tons having been obtained in 1900; but West Australia promises to become a large producer of copper. Deposits of this mineral giving every prospect of payable results are found from Kimberley in the north to Phillips river in the south.

POLAR REGIONS.

Exploration of the Kara Sea.—The Russian Hydrographical Expedition of the Ministry of Marine will next summer devote its activity to the exploration of the Kara sea, having last year completed the exploration of the straits leading to that sea. It will be under Colonel Vilkitsky, and will consist of Captain Warneck, five officers, a doctor, and fifty men.

Botanical Expedition to East Greenland.—Supported by a grant from the

"Carlsberg fund," the Danish botanist Kruse has sailed for Angmagsalik, on the East coast of Greenland, for the purpose of studying thoroughly the flora of that coast, especially between Cape Farewell and Scoresby sound. Dr. Kruse, who is accompanied by his wife and child, purposes to make a lengthened stay in East Greenland.

Mr. Steenstrup's Voyage to Disco Island.—On a voyage to Disco in 1898, Mr. K. J. V. Steenstrup investigated the colour of sea-water, employing a long tube closed at the bottom with glass, which was let down into the sea and cut off all side light. He had formerly used for comparison pieces of coloured cardboard, but the colours were too dull compared to those of sea-water, and did not give a continuous series of tints—a defect which is also common to the Forel scale. On this occasion he took with him small glass plates varying in tint from light blue through green to yellow, and these he placed in a holder with a prism attached, which, projecting over the edge of his tube, presented the light through the plates side by side with the water. Having chosen a combination of plates which reproduced most closely the colour of the water at each observation, he noted the numbers attached to them, and on his return to Copenhagen was able to imitate, with the chemicals used by Prof. Forel, the colour of the water in different parts of the sea, and compare it with the specimen of plankton taken at the same time. It was found that with twelve to fifteen pieces of glass every tint of sea-water could be obtained. The plankton was drawn by a pump through a filter of hardened paper placed horizontally between two small glass filters, by which means Mr. Steenstrup obtains, he believes, the exact contents of the water more thoroughly than with a plankton-net, while the chaplets of diatoms remained unbroken. The examination of the samples is as yet incomplete, and at present it can only be said that the well-known fact is confirmed that plankton is more abundant in deep greenish-yellow water than in blue. From Godhavn Mr. Steenstrup rowed along the coast to the Kuganguak valley, which had only once been visited before—by Mr. E. Whymper in 1872. Mr. Steenstrup travelled up it for three days, and found its length to be fully 23 miles. It lies between mountains 3300 to 4900 feet high, and perhaps more. Ferruginous andesite, similar to that discovered years ago at Asuk, was noticed on the southern flank. Kuganguak is the largest river in Disco, though the name is a diminutive, probably in reference to the large river draining the interior of the Nugsuak peninsula. The journey back to Godhavn was made along the shore, where fossils from the Cretaceous and Tertiary beds were collected, and measurements taken of the glaciers, especial attention being paid to "dead" glaciers, that is, those which are buried under such a large mass of detritus that at first sight they seem to be nothing but moraines. Among the glaciers examined were the Kutdlisat, ending at an altitude of 820 feet, with a depth of 200; the Asuk, terminating at a distance of 6½ miles from the shore at a height of 1790 feet; and the most southern of the glaciers of the Skarvefjeld near Disco, which descends to 980 feet. An excursion was also made westwards to the Disco fjord, where Mr. Steenstrup examined eight deep troughs containing glaciers, some descending from the higher lands and by their whiteness indicating a connection with the snowfield above, others "dead," cut off apparently from the snowfield and covered with detritus. Near the Mellemfjord the hottest spring known in North Greenland was discovered, with a temperature of 66° F. At Kudtlisat, Ujaragsugsuk, Erkigtok, and Godhavn the levels of easily recognizable points above the sea were determined for the purpose of detecting any future movements of the coast-line. In the *Meddelelser om Grønland*, Hefte 24, from which the above is taken, there is also a report by Dr. Nicolau on the ferruginous rocks of Disco.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Dr. Vaughan Cornish on Waves.—In the lecture to young people, on the subject of Waves, given under the auspices of the Society by Dr. Vaughan Cornish on January 8, the lecturer took as his special subject the question of the length and speed of ocean waves, the figures arrived at in regard to the height of waves having already been published and freely quoted. He said that by noting the time which elapsed between the arrival of successive waves at any point, the length and speed in deep water could be accurately calculated. During storms, waves with periods of from eight to eleven seconds were observed, with lengths from 328 to 620 feet. A ten-second wave was 512 feet long, which was exactly the length of Burlington Gardens. The sides of these waves had an average slope of not less than 1 in 10, or fully as steep as that of most of the roads marked "dangerous to cyclists." A set of such waves would have a height of about 25 feet, but there was generally a "swell" running at the same time, which increased the total rise and fall of the water, and made the waves irregular. The wave-length was, as a rule, determined by the steeper, shorter waves, but when, after a storm, these had become no steeper than the swell, it was this which became in its turn the conspicuous thing at sea, and we had commonly a wave of about fifteen seconds' period, with 1150 feet between the ridges, which is, roughly, the length of St James's Street. The majestic rollers which came in upon our shores from the Atlantic after prolonged gales which had traversed the ocean, had a much greater period. He had observed on one such occasion a series of 139 consecutive breakers with an average period of 19⅓ seconds. The length of these in deep water was more than 1900 feet. Standing at the Piccadilly end of Park Lane, and looking eastwards, let them imagine themselves on the crest of one such oceanic swell; the next crest would be just passing the Walsingham House Hotel on the top of the opposite rise. Three such crests would pass them every minute, travelling at the great speed of more than 68 miles per hour. The depth of the valley in the middle of Piccadilly was such as might occur in the case of one of these long ocean swells, which were, however, seldom so clearly marked as to admit of precise observation at sea. The existence of swells (sufficiently developed to give breakers) travelling with so great a speed had been known for many years. When the hourly velocity of wind in storms was reckoned at more than 100 miles per hour, these velocities for swells had no special significance. A novel interest attached to them now that the greatest recorded hourly velocity on our coasts was said to be 75 miles, which was not much greater than the recorded average velocity of trains of waves which arrived upon our shores as a breaking swell. Among the novelties of the lecture were lantern-slides of the 14-foot model battleships made of paraffin wax which were used by the Admiralty Experiment Works at Haslar, and of the waves they made in the tank. These unique photographs, taken by the lecturer, were shown by kind permission of the Lords of the Admiralty. The forms of waves were illustrated by a number of lantern-slides, all from the original photographs taken by the lecturer in his travels, and their motions were shown by cinematographs taken with the bioscope camera by Mr. C. Urban. One of these, of the rapids of Niagara, was shown in order to illustrate the pulsation of a rapid stream, which is entirely lost in an ordinary photograph. The lecturer concluded with an exhibition of the cinematograph picture of the Severn Bore which was described in the January number of the *Journal*.

Recent Papers on Lakes.—The methods of limnological research, and more particularly the quantitative discussion of observations by the methods of geomorphometry, have now been brought to such perfection that comparatively little room is left for modification by individual investigators—a state of affairs which

must greatly simplify the task of collating the results of workers in different regions, when the time is ripe for finally summing up and elaborating general principles. For the present, work in limnology is properly chiefly restricted to the application of these methods to the survey of special regions, and we have to record two important recent additions to the literature of this branch of the subject. The lakes of Pomerania form the subject of a memoir by Dr. Wilhelm Halbfass, published as an Ergänzungsheft of *Petermanns Mitteilungen*. About 150 lakes have been surveyed by Dr. Halbfass himself, 22 were surveyed by Prof. Keilhack, making 172 in the region east of the Oder, all of which are known with sufficient accuracy to admit of the construction of bathymetrical maps. To these may be added 107 partly surveyed but not fully sounded, giving a total of 279, with a combined area of 504·42 square kilometres. Dr. Halbfass's work, much of which is exhaustive, deals with (1) soundings, (2) variations of level, (3) temperature of water at surface and in the depth, (4) transparency of water, (5) chemical composition, (6) plankton, and (7) nature of bottom. The fifth volume of the scientific publications of the Verein für Erdkunde zu Leipzig consists of a memoir by Dr. Willi Ule on the Würmsee or Starnbergersee, in Upper Bavaria. This lake, which covers an area of about 57 square kilometres, lies within the moraine region at an elevation of 584 metres above the sea, and its survey has been of peculiar interest in revealing the action of secondary causes in modifying its form after its first formation by the damming of a channel on the retreat of a glacier. Dr. Ule's memoir deals with the geology and geomorphology first, and then with the physical conditions of the waters of the lake. A separate atlas contains eight plates of excellent maps and sections.

GENERAL.

The Livingstone Gold Medal.—We record with pleasure the foundation, by Mrs. A. L. Bruce, in memory of her father, Dr. Livingstone, of a gold medal, to be awarded by the Council of the Royal Scottish Geographical Society for exploration

THE LIVINGSTONE MEDAL OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

and geographical research. It bears on the obverse a portrait of the great explorer, and on the reverse an allegorical representation of the Spirit of Civilization

bearing the torch of Progress and the olive branch of Peace. The first medal has been awarded to Sir Harry Johnston for his distinguished services as an explorer and administrator in Africa.

The Geographical Association.—The Annual Meeting of the Geographical Association was held at the College of Preceptors on Wednesday January 15, 1902, Douglas W. Freshfield, Esq. (President), occupying the chair. The Honorary Secretary read the annual report, which pointed out the steady growth of the Association and the extension of its work through the publication of a terminal magazine, the *Geographical Teacher*, devoted to questions of geographical education. The Right Hon. James Bryce, M.P., then delivered an address, which is printed on p. 301; after which Dr. H. R. Mill, in proposing a vote of thanks to Mr. Bryce, said the great value of it seemed to him to be the way in which the subject had been brought before them, showing the comprehensiveness of geography and setting forth its enormous value as an element of culture. He (the speaker), as a physical geographer, noted with peculiar satisfaction the importance which Mr. Bryce attached to geography as a means of teaching the value of observation. They also had to thank Mr. Bryce for the very fascinating syllabus of an unwritten book, and he did not know any one better fitted than their President to become the author of such a work, which would stimulate a great many of those who could only make rare and short journeys, but who were anxious to make the most of their opportunities in order that they might subsequently give life to what he was sorry to say was very often a dead subject—the teaching of geography. Mr. Freshfield congratulated the Association on the marked and very encouraging advance in its numbers, and on the *Geographical Teacher*. In its main work, that of spreading abroad a correct conception of geography, of insisting on its position both as a science and a mental discipline, of leading teachers first and scholars afterwards to recognize that it is not, as the ignorant suppose, the same as Bradshaw—a mere cataloguing of names or exercise of memory—but the study of the features of the Earth's surface in themselves and as they affect its products and inhabitants, the Association was, he said, not standing still. The advance was not unlike that of a devious stream seeking the points of least resistance—at one moment working a channel in the fossilized beds of ancient universities, at another attacking the soft places in the more modern strata of school boards. At the present time there was not a readership or lectureship in any of our universities sufficiently endowed to allow its occupant to devote himself entirely to scientific studies of the subject such as are common in the universities of Germany, although there seemed some prospect of such a chair being founded at Edinburgh. In the English Provincial Universities, geography, we might reasonably anticipate, would hold a proper place in the scheme of education. Nor could it seriously be believed that its omission, even as a special subject, from the matriculation scheme of the new University of London, a scheme with its Sanskrit and Portuguese, was more than an accidental oversight. By practically excluding geography as a matriculation subject, the Council of this new university might be convicted of taking a course which would have an injurious effect on every middle-class school in the kingdom. Any one who helped to maintain such a decision would be doing an ill-service to his countrymen. As Dr. Mill in his Presidential address to the geographical section of the British Association said last year, the reconstituted University of London occupied the best position in the world for creating a Chair of Geographical Research, situated as it was in the very centre of the comings and goings of all mankind, and in touch with the most complete geographical library and map collection in existence. He concluded with a caution. Let us not be misled in commercial centres into

thinking that tables and statistics of trade were commercial geography; commercial geography was surely reasoned appreciation of what products any region does, or is adapted by nature to afford. It was a key to the development of commerce, to the well-being of the world, and the wealth of the people who understood it best.

Lecture to Teachers on the Use of Maps.—On January 24, Mr. A. W. Andrews gave a lecture at the London School Board to an audience composed mainly of teachers in secondary and elementary schools. The subject was the connected use of maps, and was fully illustrated by numerous lantern-slide maps, wall maps, hand maps, and diagrams, produced by the Diagram Company, showing elevation, rivers and river-basins, climate, vegetation, means of communication, history, commerce, etc. The lecture was much appreciated by the audience, and a useful discussion followed.

Scientific Journey by Dr. Genthe.—We learn from *Petermanns Mitteilungen* that Dr. S. Genthe, a pupil of Dr. Theobald Fischer, who has already made himself known by his work on the Persian gulf, is now on his way home from a three years' journey in North America, the Pacific, and Eastern Asia. In Samoa, where he spent six months, he made important studies of the folk-lore of the people; while in Korea he crossed the Kim. Gan Sang (Diamond mountains) by a new route, and collected much information on the monasteries of the country, besides acquiring some old Korean manuscripts and prints. He also paid a visit to Quelpaert, where he ascended the volcanic cone of Halassan (Aukland), and by barometric observations determined its height as 6360 feet.

"Zeitschrift" of the Berlin Geographical Society.—The decision of the Paris Geographical Society two years ago to abandon the dual system in its publications has now been followed by the Berlin Society, which from the beginning of the present year will publish one journal only, to be known as its *Zeitschrift*, in the place of the old *Zeitschrift* and *Verhandlungen*. In its new form the *Zeitschrift* will embody all the matter hitherto contained in the two separate publications, containing, like our own *Journal* and *La Géographie*, in addition to original papers, a record of progress in all branches of geography, as well as reviews of books and other publications. The 'Bibliotheca Geographica' will, however, continue to appear separately as an annual volume. The size of the new publication, which is edited by Captain Kollm, the secretary of the Society, is large octavo, and the first number already issued gives promise that it will be in every way worthy of the high reputation of the Berlin Society. The section entitled "Vorgänge auf geographischen Gebiete" is in this number less full than has usually been the case, but we hope that it will not be permanently reduced, as its completeness was a valuable feature in the old *Verhandlungen*.

New Geographical Publication.—The good work done in the United States, from the point of view of geographical education, by the *Journal of School Geography*, the publication of which has now been continued for five years, is widely known. Some two years ago a second magazine of similar scope and aims was started by the American Bureau of Geography, as the *Bulletin* of that body, which has likewise been of service to those interested in geographical teaching. It has now been decided to avoid unnecessary dispersion of energy by combining forces and replacing the two publications by a new illustrated magazine, to be known as the *Journal of Geography*, the first number of which is issued for January, 1902. The responsible editors are Prof. R. E. Dodge, of Columbia University; Prof. E. M. Lehnerts, of the State Normal School, Winona, Minnesota; and Dr. J. P. Goode, of the University of Pennsylvania; the two former having been editors of the parent magazines. Judging from the prospectus which has been issued, the new journal promises to take a high standing among kindred

undertakings. Besides original articles, illustrated with maps and pictures, it will include notes on current geographical progress, communicated by associate editors; reports on current literature, and on the *impedimenta* of geographical teaching; a department of questions and answers, furnishing teachers with an opportunity of having their difficulties solved; as well as items of personal interest respecting geographical workers. The Journal will be issued monthly (July and August excepted) at the low charge of $1.50 per year, and will be published at Boston by the J. L. Hammett Company.

United States Board on Geographic Names.—In the second report of the United States Board on geographic names, of which a limited number of copies was issued in 1900, but of which a further issue for more general distribution was made in March last, the whole of the decisions of the Board up to date, referring to some four thousand names, have been made public. The greater number of the names are those of places in the United States, but a certain number of foreign names have also been dealt with, decisions having been given in all cases of disputed nomenclature specially brought to the notice of the board. To the former class the R.G.S. system, though adopted in the case of foreign names, does not apply, regard being paid chiefly to local usage. Thus we find Chilkoot, not Chilkut, as the adopted form. Other principles followed, in accordance with which a departure from local usage is sometimes made, are, the use of the forms "burg," "boro," and "center" (for burgh, borough, and centre), the discontinuance of hyphens, the combination of two or more words into one name where practicable, (as in "Eldorado"), and the dropping of "city" and "town" as parts of names. In Russian names the termination "of" is adopted, not "ov" or "off." The following are some of the forms and spellings adopted in the case of foreign names: Fujiyama (not Fushiyama), Krakow (not Cracow or Krakau), Lassa (not Lhassa), Magellan (strait of), Malakka (not Malacca), Pechili (not Chihli), Pekin (not Peking), Tchad (not Chad), Tuamotu (not Paumotu), Yapura (not Japura). It is not quite clear why the French form Tchad is retained, but, apart from this, most of the decisions appear sensible.

OBITUARY.

The Marquis of Dufferin and Ava.

By the death of Lord Dufferin, which occurred on February 12, the Royal Geographical Society loses one of the most distinguished of its Fellows. The only son of the fourth Baron Dufferin and his wife—a granddaughter of Sheridan, the famous dramatist, Frederick Temple Hamilton-Temple-Blackwood was born in 1826, and succeeded to the title in 1841. He was educated at Eton and Oxford, and after serving as one of the lords-in-waiting at court, accompanied Lord John Russell to Vienna in 1855, when the latter tried to arrange terms of peace with Russia for the conclusion of the Crimean War. In 1860 he went out to the near East as British Commissioner to inquire, in conjunction with the representatives of the other European Powers, into the Syrian massacres, and subsequently held various offices of State at home, till, in 1872, he was appointed Governor-General of Canada. This post he held for six years, returning home in 1878, only to be appointed almost immediately British Ambassador at St. Petersburg, whence he was transferred two years later to Constantinople, to conduct the delicate negotiations with the Porte

which arose out of the troubles in Egypt. On the suppression of the revolt under Arabi Pasha, he proceeded to Cairo, and, having effected a settlement there, was appointed Viceroy of India in 1884. Four years later he returned to Europe to become British Ambassador at Rome, and from 1891 to 1896 occupied a similar position at Paris.

Primarily, of course, Lord Dufferin was a great statesman and diplomatist, filling the various important offices to which he was appointed with marked distinction, and receiving numerous honours for his valuable services to the empire. But his many-sided character enabled him to appreciate and sympathize with every movement which tended to the advancement of human knowledge, and he took a warm interest in the work of exploration and geographical science. The brief record of his public career given above shows that he was one of the most widely travelled of men; and whilst in Canada and India he was no mere fixture at Ottawa and Calcutta, but was constantly undertaking extensive journeys with the object of making himself thoroughly acquainted with the countries in which he was the representative of the Crown. He was the author of a charming book of travel entitled 'Letters from High Latitudes,' in which he recorded his experiences on a yachting cruise to Iceland in 1856. In 1857 he became a Fellow of the Royal Geographical Society, of which he was elected President in 1878. His speedy appointment to the ambassadorship at St. Petersburg after his return from Canada, compelled him to resign this office before he had fully entered upon its duties, but he greatly appreciated his election to the presidency. As he himself said at the first of the two evening meetings at which alone he was able to preside, "Although I have no claim whatever to be regarded as a scientific geographer, at all events there is one respect in which I can conscientiously consider myself the equal of any of those who have preceded me, and that is in a sincere and enthusiastic desire to promote geographical research, in a profound conviction of the utility of the functions discharged by this Society, and in a respectful and affectionate sympathy with those brave and gallant men who year by year are sent forth under our auspices."

CORRESPONDENCE.

The Hydrography of the Sobat Region.

On my return to England, I had the honour to write a paper for the Royal Geographical Society on my surveys in the Sobat region, giving some description of our travels, the geographical features of the country, and the people met with. I then expressed it as my opinion that a certain river the late Captain Wellby crossed, at about lat. N. 7° 50′, which he described as "30 yards broad, from 8 to 10 feet deep, flowing about 3 miles an hour, and infested with alligators," was the Gelo, which we had followed. This paper appeared in the *Geographical Journal* of May, 1901. Since my return to England recently from my subsequent expedition—to Lake Rudolf and British East Africa from the Soudan—I see by the September number of the *Journal* that my identifications have led to a certain amount of controversy on the part of Herr Brix Forster in *Globus*. I had ventured to suggest that the Ruzi I. of Captain Wellby was the Akobo, as no other stream could possibly be identified with it in these regions. Herr Forster asks, "How can the Ruzi of Wellby, which flows generally from south to north, be the Akobo, which, as originally explored by Bòttego, was found to have a course from south-east to north-west?" It may be remembered that we had only followed the Akobo for

two days before reaching its junction with the Pibor, and from what I saw of the river systems of that region I felt convinced that the Ruzi which Wellby described as joining the river above mentioned, "30 yards broad," etc., really did nothing of the sort, but flowed by an independent course into the Pibor. My late expedition has fully justified that opinion, and there is absolutely no doubt that the two rivers do not meet, but flow independently into the Pibor—the Akobo at lat. N. 7° 47′ 41″·4 and the Gelo at lat. N. 8° 8′ 45″ (about; I was unable to get observations at the actual junction). We followed the Akobo recently from the Pibor junction generally in a south-easterly direction to lat. N. 6° 44′ 8″, where we left it to strike south. Wellby came upon a large river at about this latitude—N. 6° 40′ I think he gave as the approximate position—which he imagined was his Ruzi I., of which he had seen nothing for many days. It in reality was the Akobo or Juba of Bòttego, and was the same stream as the one we had marched south to from the Gelo the previous year. I venture to state that his original Ruzi I., which he last saw south of the 5th degree north latitude, turning off east—if it does not get lost in the plains altogether—finds its way to Lake Rudolf at times of exceptional flood, after heavy rains. It certainly never flows continuously north as shown on his map, for to do so it would have to penetrate mountain ranges which drain south. That, I think, may be regarded with considerable confidence as being its real fate.

Now for Ruzi II. This stream was first met with by Wellby, he said, about lat. N. 5° 30′, where it was flowing west over an open plain, with nothing to indicate its course. That same stream was met both by Dr. Donaldson Smith and myself subsequently, and I entirely agree with the latter that it does not turn north as shown by Wellby. To do so it would have to run uphill for some 20 or 30 miles before it could obtain the benefit of a down-grade again! —according to my barometric readings. My own impression is—and I think probably Dr. Donaldson Smith will support me—that that stream continues west, until it finally becomes absorbed by the inhospitable plains which it enters. However, further north Wellby came upon another stream, which he imagined to be Ruzi II. again after it had swung from west to north away out over the plains. I am inclined to think that, in reality, he had got on to the stream that drains the escarpment to the east, the tributaries from which flow into the plain in a westerly direction, and then swing north at this point—favoured by the *now* northerly fall in the ground towards the Akobo. He never saw that river again until after reaching the Akobo (which I have previously mentioned he thought was possibly his original Ruzi I.). After proceeding some way up the Akobo, he found two rivers flowing almost parallel to each other and only a few miles apart. He crossed the more westerly one twice in his journey north, and then formed an opinion that the two joined after he had finally crossed the easterly one, or the Akobo. Now, I went to much trouble in attempting to identify his Ruzi II. thereabouts; his Ruzi I. here may be accepted as being the Akobo beyond all shadow of doubt, to my mind. We came across a swampy stream, known to the Anuaks as the Oboth, which is possibly—it is quite impossible to say for certain—joined by the stream met with by Wellby north of 5° 30′ before reaching the Akobo. The Oboth, the Anuaks told us, branches off from the Akobo, is joined by another stream from the south, and the two then flow north close to the Akobo for a time, before swinging west towards the Pibor. This agreed with my idea of the river system, as by our journey up the Akobo it was evident that that river was not joined by any other on the left bank, of the importance of Wellby's Ruzi II. The Ruzi I., therefore, is never joined by the Ruzi II. of Wellby, and there is no "combined Ruzis" to join the river "30 yards broad," etc.;

for I have already shown that the Akobo and Gelo flow by independent courses into the Pibor. My identification of Wellby's river, which he described as "30 yards broad," etc., with the Gelo is questioned on the plea of the great discrepancy in latitude. Wellby met that stream, he said, at lat. N. 7° 50′. Now, what are the various latitudes I obtained when following the Gelo?

(1) Camp 8/5/00. N. 7° 50′ 42″.

(2) Camp 11/5/00. N. 7° 52′ 36″·6, near where we left the Gelo to march to the Akobo; and Patok village, where the Gelo was first struck from the Baro, was N. 7° 44′ 5″.

From the above it will be observed that the discrepancy is not so great as the N. 6° 40′ of Wellby for his Ruzi I.—the Akobo in reality—where he first met the latter. I am still of unshakable opinion that the Gelo and Wellby's river "30 yards broad," etc., are one and the same stream, and that he followed the latter in a north-westerly direction to the Pibor, which is shown in his map as having been reached somewhat to the north of the 8th degree of latitude. The question of longitudes need not be entered into; we are considerably at variance on that point. I have gone rather in detail into the question of the Ruzis, as the Egyptian authorities have been much puzzled, and Colonel Talbot's first question almost on our return was, "What about Wellby's Ruzi?" I have worried the matter out to the best of my ability, and I think the grounds I have given are reasonable ones. It must be remembered that in those level grassy plains over which rivers take the most erratic and unlooked-for courses, Wellby's reasoning could very easily be at fault, as one sees comparatively so little of the actual courses of the streams. I perhaps had better opportunities, but some of my surmises may be incorrect regarding streams not actually followed. With regard to the Akobo and Gelo I have no doubt.

H. H. Austin, Major and Captain R.E.

The Belgian Antarctic Expedition.

There are some historical mistakes in M. Arçtowski's lecture on the Belgian Antarctic Expedition (*Geographical Journal*, October, 1901).

The writer says (p. 355) that Captain de Gerlache's scheme was to undertake *a voyage of adventure*, and that it was one of the members of the council of the Royal Geographical Society (Brussels) who suggested to him the plan of a scientific expedition—"an idea," writes M. Arçtowski, "which made its way in the course of time."

I knew de Gerlache long before M. Arçtowski or any other of the staff of the expedition became acquainted with him, and as I was one of the first to whom he expressed his ideas on the subject, I am in a position to ascertain that *from the very beginning* it was the captain's mind to undertake a scientific expedition. He expressly and repeatedly insisted upon this point—saying, for instance, in his note to the Royal Geographical Society (Brussels) that the expedition, not being a purely geographical one, but having for its object the study of scientific problems in the unexplored area of the antarctic seas, was bound to bring a rich harvest of results. This, I believe, has proved to be the case.

M. Arçtowski also complains (p. 357) about the lack of any written contract between the staff and the leader of the expedition. But this, I remember, was agreed between all of them, and it certainly proved to be mostly to the benefit of de Gerlache's companions, who were free to publish anything on the expedition and its results without obstruction whatever.

I also wonder why, on the chart annexed to M. Arçtowski's paper (read in June, 1901), the strait which was discovered and surveyed by the commander and staff of the expedition, should be named "Belgica strait," while it was in March, 1900, that, after the suggestion of de Gerlache's companions themselves, and in recognition of his services to science, his own name was given to the strait.

My friend certainly deserved this mark of gratitude, for if the results of the expedition show that every one on board did his duty, there would certainly never have been a Belgian Antarctic Expedition without de Gerlache's continuous exertions from the time he made his project public, to the departure (three years later); and the results of the expedition could not possibly have been collected without the commander's aid and good-will, and without a great deal of nautical skill on his part.

PAUL PELSENEER, D.Sc.
Corresp. Member of the Belgian Academy of Science.

WITH Dr. Pelseneer, I share the opinion of everybody that the Belgian Antarctic Expedition was the work of Commandant de Gerlache. I know what difficulties he had to surmount, and with what perseverance he overcame them, and certainly all the honour of the success of the enterprise is due to him—and to his excellent captain, Mr. Lecointe.

I do not admit the "historical mistakes" which Dr. Pelseneer supposes me to have made in my lecture of June 24, 1901.

As a matter of fact, the first recorded *document* of the expedition is a memoir (in the form of an autographical reprint) entitled "Projet d'organisation d'une expédition belge pour l'exploration de l'Océan Antarctique" [by de Gerlache], presented, October 5, 1894, to the Council of the Royal Belgian Geographical Society by the secretary, M. Du Fief, who had been acquainted with the project of de Gerlache, and had even discussed the question with him for some time. It was after a favourable report on this memoire by MM. Leclercq, Pavoux, and Goblet d'Alviella, that the Geographical Society of Brussels accorded its patronage to the project, in the commencement of November, 1894.

In this memoir, which can be consulted at the Society, there is an historical account of antarctic expeditions, and mention is made of the projects of Baron Nordenskiöld, Dr. Neumayer, and Sir John Murray. On the last page one finds—this page is full of scratched-out words, and has many corrections tacked on—a programme of scientific researches to be undertaken, and, on the page before, mention is made of certain *collaborateurs* from the Observatory. In the *Mouvement Géographique*, of November 25, 1894, we read that "Un groupe de jeunes savants belges, appartenant au monde de la marine, des sciences naturelles, astronomiques et météorologiques, et attachés à plusieurs de nos grands établissements ou services publics, s'occupent de mettre sur pied une expédition . . ." And a few months later, in an article published in *La Réforme* (March 17, 1895), we learn the names of these gentlemen: Lameere, Massart, Prinz, Vincent, Stroobant. The names of these first collaborators are quite sufficient to show that the "plan of a scientific expedition" grew out of a certain *milieu* favourable to the development of such ideas. In consequence, I maintain—until proved of to the contrary—that "the plan of a scientific voyage was suggested to M. de Gerlache."

As the first documents are not sufficiently numerous, there can always remain a difference of opinion, and I think that I am not the only one who does not share that of Dr. Pelseneer. Besides, during the voyage of the *Belgica*, Commandant de

Gerlache often came back to his first idea—the south pole—towards which his courageous, persevering and daring spirit still led him. I was, and I am still, of the opinion that this fixed idea—farthest south—is not compatible with that of an expedition of scientific exploration.

But why does Dr. Pelseneer take exception to the fact that a seaman should imagine a voyage of discovery (which is most natural) rather than one of science?

Secondly, I must draw the attention of Dr. Pelseneer to the fact that it is not only now, but also before the departure of the *Belgica* from Antwerp, and during the voyage, that I "complained" of the lack of any written contract, written instructions, and defined programme for the voyage. Consequently, it would be "a historical mistake" to state that a "lack of written contract was agreed between all" of us.

Lastly, the chart inserted in my paper is a copy of Captain Lecointe's map published in the *Bulletin* of the Geographical Society of Brussels (January, 1900), which is, until now, the only official record of the cartographical work of the Expedition. The Admiralty has already taken into consideration this chart, so that the name of "Belgica strait" was printed in August, 1900, and March, 1901, on the map [1113]: South Shetland and South Orkney. Farther, it is to be regretted that the *Belgica* Commission has not officially communicated the decision of changing the name of the strait to the different geographical institutions and societies, a decision which is contrary to that of the Seventh International Congress for the "Rules for Geographical Nomenclature," but which, I hope, would be accepted by the Admiralty and all geographers, if it were officially known.

HENRYK ARÇTOWSKI,
Of the Scientific Staff of the Expedition.

Waldseemüller's "Solidum."

59, Drakefield Road, Upper Tooting, S.W., Feb. 4, 1902.

WITH reference to the interpretation of the word *solidum* in the title of the 'Cosmographiæ Introductio' of Waldseemüller referred to in the interesting article in this month's number of the *Journal* on "The First Map containing the Name America," it may be worth while to point out that Egli, in his 'Nomina Geographica' (2nd edit.), under the entry America, speaks of a globe as the work to which this 'Introductio' was to serve as a companion, and adds that a copy (?) of the segments of this globe, perhaps a unique specimen, is to be found in the collection of Gen. Steinhauser in Vienna. I have ventured to treat Egli's "Ex. der Segmente" as equivalent to "Exemplar der Segmente." Dr. Egli had the bad habit of sometimes using abbreviations without explaining them. Possibly an inquiry addressed to Gen. Steinhauser might clear up this matter.

GEO. G. CHISHOLM.

Glaciation.

"Glaciation" (*Journal*, p. 192) is a term already appropriated by geologists to express the effect on the surface of the Earth of ice. Lately it has been frequently used to express the amount of surface covered by ice. Ought not some definite decision as to which sense is to prevail be come to in order to prevent ambiguity?

D. W. F.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1901–1902.

Fifth Ordinary Meeting, January 27, 1902.—Sir T. H. HOLDICH, R.E., K.C.I.E., C.B., Vice-President, in the Chair.

ELECTIONS.—*John Aungier; W. Heywood Brettell; John Sadler Curgenven, M.R.C.S., L.R.C.P.; Major Richard Crawshay; Lionel Rayne Foot; Major-Gen. Sir Alfred Gaselee, G.C.I.E., K.C.B.; John Calcott Gaskin; Harold F. Hall; Commr. Arthur Russell Hulbert, R.N.; William Hesketh Lever; Lieut. Percy Calvert Lord, R.E.; Captain John Talbot Lutley, Imperial Yeomanry; Hugh Macdonald, M.B.; Lieut.-Col. C. Martyr, D.S.O.; Sir Guilford Lindsey Molesworth, K.C.I.E.; Herbert Barrow Montefiore; John J. Nicholl; Frederick Phillips Percival; William Blackstone Rennell; Captain Rokeby-Robinson, D.A.A.G. Head-Quarters Staff; T. Featherstone Smith; Edward Thomas Scammell, F.S.A.; Major B. M. Skinner, R.A. Med. Corps.; Herbert Ruston Sykes, B.A.; W. A. Taylor, M.A., F.R.S.E.; Lewis Norman Way.*

The Paper read was:—

"The Formation of the Maldives." By J. Stanley Gardiner, M.A.

Afternoon Technical Meeting, Wednesday, January 29, *at* 4 *p.m.*—General Sir H. W. NORMAN, G.C.B., G.C.M.G., C.I.E., in the Chair.

The Paper read was:—

"The Artesian Water-Supply of Queensland from a Geographical Standpoint." By W. Gibbons Cox, C.E.

Sixth Ordinary Meeting, February 10, 1902.—G. S. MACKENZIE, ESQ., C.B., Vice-President, in the Chair.

ELECTIONS.—*Byron Brenan, C.M.G.; Sir Euan Cameron, K.C.M.G.; Walter Maximilian De Zoete; Lieut. Arthur J. G. Hargreaves, Somerset L.I.; David Q. Henriques; Frederick Lambert; Allan Gordon McArthur; John Thomas Mearns, M.D.; Lieut. Henry du Bois O'Neill, 6th Batt. King's African Rifles; Reginald Albert Priestley; E. Aubrey Thomas; Earle Wellington Jenke Trevor; Rev. Maxwell Frederick Webb; Arthur Oliver Wheeler, Topographical Surveys Staff, Dept. of Interior, Canada.*

The Paper read was:—

"The Ancient Kingdom of Kongo." By the Rev. Thomas Lewis.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

THE following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = **Academy, Academie, Akademie.**	**Mag.** = **Magazine.**
Abh. = **Abhandlungen.**	**Mem.** = **Memoirs, Mémoires.**
Ann. = **Annals, Annales, Annalen.**	**Met.** = **Meteorological.**
B. = **Bulletin, Bollettino, Boletim.**	**P.** = **Proceedings.**
Com. = **Commerce.**	**R.** = **Royal.**
C. Rd. = **Comptes Rendus.**	**Rev.** = **Review, Revue.**
Erdk. = **Erdkunde.**	**S.** = **Society, Société, Selskab.**
G. = **Geography, Geographie, Geografia.**	**Sitzb.** = **Sitzungsbericht.**
Ges. = **Gesellschaft.**	**T.** = **Transactions.**
I. = **Institute, Institution.**	**V.** = **Verein.**
Iz. = **Izvestiya.**	**Verh.** = **Verhandlungen.**
J. = **Journal.**	**W.** = **Wissenschaft, and compounds.**
k. u. k. = **kaiserlich und königlich.**	**Z.** = **Zeitschrift.**
M. = **Mitteilungen.**	**Zap.** = **Zapiski.**

On account of the ambiguity of the words *octavo, quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. **Coolidge.**
W. A. B. Coolidge. La Catena della Levanna (Alpi Graie Centrali). (Estratto dal *Bollettino del Club Alpino Italiano*, vol. xxxiv., 1901, n. 67, pp. 1–44.) *Illustrations. Presented by the Author.*

Alps. **Penck and Brückner.**
Die Alpen im Eiszeitalter. Von Dr. Albrecht Penck und Dr. Eduard Brückner. Lieferung i. Leipzig: C. H. Tauchnitz, 1901. Size 10½ × 7½, pp. 112. *Illustrations.*

Alps—Mont Iseran. **Coolidge.**
W. A. B. Coolidge, La Légende du Mont Iseran. Étude d'histoire topographique. (Extrait de l'Annuaire du Club Alpin Français. 27e volume, 1900, pp. 1–63.) *Maps and Illustrations. Presented by the Author.*

Alps—Morphology. **Penck.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 232–240.
Die Uebertiefung der Alpen-Thäler. Von Prof. Dr. Albrecht Penck.

Austria. *Sitzb. A.W. Wien* **109** (*Ab. I.*) (1900): 527–651. **Mazelle.**
Mittheilungen der Erdbeben-Commission der Kaiserlichen Akademie der Wissenschaften in Wien. XIX. Die tägliche periodische Schwankung des Erdbodens nach den Aufzeichnungen eines dreifachen Horizontalpendels zu Triest. Von Eduard Mazelle. *With Plan and Diagrams.*

Austria—Bohemia. *Globus* **80** (1901): 345–356. **Zemmrich.**
Das deutsche Sprachgebiet in Süd- und Ostböhmen. Von Dr. J. Zemmrich. *Maps.*
A continuation of the study referred to in the *Journal* for November, 1900 (vol. xvi. p. 553).

Austria—Bosnia. *Globus* **81** (1902): 37–39. **Katzer.**
Die ehemalige Vergletscherung der Vratnica planina in Bosnien. Von Dr. Friedrich Katzer.

Austria—Bosnia and Herzegovina. *B.S.R.G. d'Anvers* **25** (1901): 277–290. **Koŝcak.**
La Bosnie et l'Herzégovine. Par le Dr. Jean Koŝcak.

Austria—Hungary—Canals. *G.Z.* 7 (1901): 545–573. **Sieger.**
Kanäle und Kanalprojekte in Österreich-Ungarn. Von Prof. Dr. R. Sieger.

Austria—Tirol. *Globus* **80** (1901): 356–358. **Jaeger.**
Das Bozener Land. Eine erdgeschichtliche Betrachtung. Von Julius Jaeger.

Balkan Peninsula—Montenegro. *B.S.G. Italiana* **2** (1901): 945–950. **Baldacci.**
Un' escursione archeologica del dott. Roberto Paribeni nel Montenegro, nota del dott. A. Baldacci.

Central Europe—Flora. **Schulz.**
Die Verbreitung der Halophilen Phanerogamen in Mitteleuropa nördlich der Alpen. Von Dr. August Schulz. (Forschungen zur deutschen Landes- und

Volkskunde . . . herausgegeben von Dr. A. Kirchhoff. XIII. Band, Heft 4.) Stuttgart: J. Engelhorn, 1901. Size $9\frac{1}{2} \times 6\frac{1}{2}$, pp. 271–360.

Eastern Europe—Mountain Structure. **Philippson.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 181–191.
Der Gebirgsbau der Ägäis und seine allgemeineren Beziehungen. Von Prof. Dr. A. Philippson.

Europe—Censuses. *Rev. Française* **26** (1901): 654–667, 724–731. **Cilvanet.**
Les Recensements de Population. Par C. Cilvanet.

Europe—Geodesy. ———
Publicationen für die Internationale Erdmessung. Die Astronomisch-Geodätischen Arbeiten des K. und K. Militär-Geographischen Institutes in Wien. XVII. Band. Astronomische Arbeiten. 6. Polhöhen und Azimuth-Messungen auf den stationen Bernstein, Brno, Čebon, Pecný, Sadská, Studený Vrch, Tillenberg, Veliš (nur Polhöhe), Vysoká und Žbán. Herausgegeben vom K. und K. Militär-Geographischen Institute. Wien, 1901. Size $12 \times 9\frac{1}{2}$, pp. x. and 206. *Presented by the Institute.*

Europe—Historical. *B.S.G. Italiana* **2** (1901): 976–995. **Garofalo.**
Sulla geografia delle *Gallie* sotto l'Impero Romano. Nota del Prof. Francesco P. Garofalo.

Europe—Historical Geography. *O Instituto* **48** (1901): 530–536, 819–827. **Garofalo.**
Studi di Geografia Greca. Pelo Prof. F. P. Garofalo.

Discusses the geographical knowledge of the Iberian peninsula possessed by Hecatæus of Miletus and Timæus.

Europe—Hydrography. **Pettersson.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 334–342.
Ueber systematische hydrographisch-biologische Erforschung der Meere, Binnenmeere, und tieferen Seen Europas. Von Prof. O Pettersson. *With Plate.*

Europe—Political. *B.S.G. Rochefort* **23** (1901): 238–243. ———
Un condominium dans l'Europe Centrale: Moresnet. *With Map.*

On a wedge of neutral territory, some 3 miles long, between Belgium and Germany just south of the Dutch frontier.

France. **Maillet and others.**
Résumé des Observations Centralisées par le Service Hydrométrique du Bassin de la Seine pendant l'Année 1899. Par M. Maillet. Versailles, 1900. Size $10\frac{1}{2} \times 7$, pp. 56.
Observations sur les cours d'Eau et la Pluie Centralisées pendant l'Année 1899. Par M. G. Lemoine, M. Babinet, et M. E. Maillet [7 Plates]. Size $16\frac{1}{2} \times 11$.

France. **Vidal de la Blache.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 498–501.
De l'Habitation sur les Plateaux limoneux du Nord de la France. Par Prof. P. Vidal de la Blache.

France—Ardèche. *Alpine J.* **20** (1901): 504–507. **Anderson.**
The Coupe de Jaujac. By Tempest Anderson. *With Illustrations.*

On a visit to the mountain *massif* on the right bank of the Rhone below Lyons.

France—Beaujolais. *Rev. Scientifique* **17** (1902): 79–82. **Privat-Deschanel.**
Les conditions géographiques de la vie animale dans le Beaujolais. Par M. Paul Privat-Deschanel.

France—Cartography. **Drapeyron.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 897–920.
Enquête sur la première grande Carte topographique, celle de France. Par César François Cassini de Thury. Documents inédits recueillis par le Prof. Ludovic Drapeyron.

France—Gascony. **Saint-Jours.**
B.S.G. Com. Bordeaux **27** (1901): 213–228, 233–246, 253–260.
L'âge des dunes et des étangs de Gascogne. Par M. Saint-Jours. *With Maps.*

France—Gascony. *B.S.G. Com. Bordeaux* **27** (1901): 364–366. **Saint-Jours.**
Au Sujet des eaux de Hourtin et de Lacanau. Par M. Saint-Jours.

On the disputed question of the cause of the decrease in depth of the lakes since the seventeenth century.

France—Gascony. *J. School G.* **5** (1901): 289–293. ——

The Dunes and Landes of Gascony.

Reprinted in part from the Annual Report of the State Geologist (New Jersey) for 1899.

France—Isle of Aix. *B.S.G. Rochefort* **23** (1901): 173–175. **Pawlowski.**

Carte-plan de l'ile d'Aix dressée par Cornuau, en 1672, présentée avec une note explicative. Par M. A. Pawlowski.

France—Levelling. **Lallemand.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 32–52.

Le Nivellement Général de la France, ses progrès de 1895 à 1899. Par M. Ch. Lallemand.

France—Lorraine. *B.S.G. de l'Est* **21** (1900): 424–442, 551–574. **Merchier.**

Un coin de Lorraine.—Le Barrois.—Nancy. Par M. A. Merchier.

France—Surveys. **Lallemand.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 72–84.

La Réfection du Cadastre, et la Carte de France. Par M. Ch. Lallemand.

Germany. *Rev. Maritime* **151** (1901): 2184–2194. **Bœufvé.**

Le port de Bremerhaven et les ports secondaires du Weser. Par E. Bœufvé.

Germany.

Deutschland auf den Hochstrassen des Weltwirtschaftsverkehrs. Von Arthur Dix. Jena: Gustav Fischer, 1901. Size 9½ × 6¼, pp. x. and 218.

This will be noticed elsewhere.

Germany. *Petermanns M.* **47** (1901): 233–235. **Langhans.**

Die Wassererwerbs-Bevölkerung im Deutschen Reiche, insbesondere die Binnenschiffahrts-Bevölkerung. Von Paul Langhans. *With Map.*

Germany. *Globus* **80** (1901): 142–144. **Marcuse.**

Das Briquetagegebiet von Vic, Deutsch-Lothringen. (Ausflug der Deutschen Anthropologischen Gesellschaft am 6 August.) Von Dr. Julian Marcuse.

This district owes its name to the great accumulations of fragments of baked clay, which seem to have been employed in the salt works carried on here from the earliest times.

Germany—Aurich. **Thiele.**

Die Volksverdichtung im Regierungsbezirk Aurich. Von Dr. Otto Thiele. (Forschungen zur deutschen Landes- und Volkskunde . . . herausgegeben von Dr. A. Kirchhoff. XIII. Band, Heft 5.) Stuttgart: J. Engelhorn, 1901. Size 9½ × 6½, pp. 363–426. *Map.*

The district here dealt with is in the north-west of Hanover.

Germany—Brandenburg and Pomerania. **Hellmann.**

Regenkarte der Provinzen Brandenburg und Pommern sowie der Grossherzogtümer Mecklenburg-Schwerin u. Mecklenburg-Strelitz. Mit erläuterndem Text und Tabellen. In amtlichem Auftrage bearbeitet von Prof. Dr. G. Hellmann. Berlin: D. Reimer, 1901. Size 10½ × 7, pp. 40. *Map.*

Germany—Cartography. **Ruge.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 884–896.

Die Anfänge der Kartographie von Deutschland. Von Prof. Dr. Sophus Ruge.

Germany—Early Trade. **Walter.**

Bericht Ges. Völker- u. Erdk. Stettin (1897-98 u. 1898-99): 21–22.

Arabischen Tauschhandel in Norddeutschland zur Zeit des 9. bis 12. Jahrhunderts. Von Prof. Dr. Walter.

Germany—Eifel. *B.S.G. Lille* **36** (1901): 317–328. **Six.**

L'Eifel, région montagneuse de la rive gauche du Rhin. Par M. Georges Six. *With Illustrations.*

Germany—Glaciation. **Wahnschaffe.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 289–298.

Die Ausbildung und Gliederung der Glacial Bildungen des nord-deutschen Flachlandes. Von Prof. Dr. F. Wahnschaffe.

Germany—Riesengebirge. **Partsch.**
Der Ausflug des XIII. Deutschen Geographentages zu den Glacialablagerungen des Riesengebirges. Von Prof. Dr. J. Partsch. (Sonderabdruck aus der Schlesischen Zeitung.) Size 9 × 6, pp. 20.

Germany—Rivers. *Petermanns M.* **47** (1901): 208–214. **Partsch.**
Memel-, Pregel- und Weichselstrom. Bericht über das grosse Werk des Hochwasser-Ausschusses. Von Prof. Dr. J. Partsch.

A full summary of the results of researches published by the German Water-Office in 1899 (*Journal*, vol. xvi. p. 552).

Germany—Silesia. **Frech.**
Führer für die geologische Exkursion des XIII. Deutschen Geographentages nach Oberschlesien . . . bearbeitet von Prof. Dr. F. Frech. Breslau, 1901. Size 8 × 5½, pp. 20.

On the general geology and coal-deposits of Upper Silesia.

Iceland. *G. Tidskrift* **16** (1901–1902): 58–82. **Thoroddsen.**
Islandske Fjorde og Bugter. Af Dr. Th. Thoroddsen. *With Map.*

This will be specially noticed.

Italy. **Cruickshank.**
Grant Allen's Historical Guides. The Umbrian Towns. By J. W. and A. M. Cruickshank. London: Grant Richards, 1901. Size 7 × 4½, pp. 400. *Plans. Price* 3*s.* 6*d. net.*

Contains, besides introductory notes on the history of Umbria and its monuments, detailed descriptions of Perugia, Assisi, Orvieto, and several smaller towns.

Italy—Lakes. **Agostini.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 259–262.
Bathometrie der Italienischen Seen. Von Dr. Giovanni de Agostini. *With Plate.*

Mediterranean. ——
Guide to the Eastern Mediterranean. London: Macmillan & Co., 1901. Size 7½ × 4½, pp. xxviii. and 246. *Maps and Plans. Price* 9*s.*
Guide to the Western Mediterranean. London: Macmillan & Co., 1901. Size 7 × 4½, pp. xxvi. and 238. *Maps and Plans. Price* 9*s. Presented by the Publishers.*

The guides of this series which have so far appeared are the subject of a notice in the present number of the *Journal* (p. 366).

Norway—Fjords. *Geolog. Mag.* **8** (1901): 555–558. **Hull.**
On the Physical History of the Norwegian Fjords. By Prof. Edward Hull.

The author is one of those who regard the submarine valleys off the coast of Norway as due to river-action when the land stood at a higher level, but adduces no proofs of this supposition.

Russia. *Mém. Comité Géolog.* **18**, No. 1 (1901): 1–104. **Morozewicz.**
Le Mont Magnitnaia et ses alentours. Par J. Morozewicz. *With Map and Plates.* [In Russian, with abridged French version.]

Mainly a geological study. The mountain lies on the east of the Upper Ural.

Russia. *Verh. Siebenten Internat. G. Kongresses*, 1899, **2** (1901): 263–268. **Shokalsky.**
Le Lac de Ladoga au point de vue thermique. Par Lieut.-Colonel Jules de Schokalsky. *With Plates.*

Russia. *Mém. Comité Géolog.* **18**, No. 2 (1901): 1–79. **Sokolov.**
Die Manganerzlager in den Tertiären Ablagerungen des Gouvernements Jekaterinoslaw. Von Dr. N. Sokolov. *With Maps and Illustrations.* [In Russian, with *résumé* in German.]

Russia. *Verh. Siebenten Internat. G. Kongresses*, 1899, **2** (1901): 810–811. **Tillo.**
Untersuchung der Quellengebiete der Flüsse des Europäischen Russlands. Von General-Leutnant Dr. A. von Tillo.

Russia—Fauna. **Nehring.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 463–466.
Ueber die heutige Fauna der russischen und westsibirischen Steppen in ihrer Beziehung zu der pleistocänen Steppenfauna Mittel-Europas. Von Prof. Dr. A. Nehring.

Russia—Flora. **Krassnow.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 457–462.
Die Flora der südrussischen Steppen, ihre Verbreitung und die Geschichte ihrer Ansiedelung. Von Prof. Andreas Krassnow.

Russian Empire—Area. **Tillo.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 808–809.
Nouvelle détermination de la superficie de l'Empire de Russie. Par Lt.-Général Dr. A. de Tillo.

Southern Europe. **Gordon.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 167–180.
The Crust-Basins of Southern Europe. By Mrs. Ogilvie Gordon. *With Plate.*

Sweden and Norway. *P.I. Civil Engineers* **146** (1901): 229–241. **Bache.**
Peat Fuel in Scandinavia. By Alfred Bache.

The possible yield of the great Swedish peat-bogs has been estimated to be equivalent to 3000 million tons of coal.

Switzerland—Rhone Glacier. **Hagenbach-Bischoff.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 269–278.
Vermessungen am Rhone-Gletscher während 25 Jahren. Von Prof. Ed. Hagenbach-Bischoff.

United Kingdom—Ethnology. *Nature* **65** (1901): 39-40. **Dawkins.**
The Influence of the Mediterranean Peoples in Prehistoric Britain. By Prof. W. Boyd Dawkins, F.R.S.

United Kingdom—Historical. **Sieglin.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 845–876.
Entdeckungsgeschichte von England im Alterthum. Von W. Sieglin.

United Kingdom—Meteorology. *P.R.S.* **69** (1901): 61–85. **Shaw and Cohen.**
On the Seasonal Variation of Atmospheric Temperature in the British Isles and its Relation to Wind-direction, with a Note on the Effect of Sea Temperature on the Seasonal Variation of Air Temperature. By W. N. Shaw and R. Waley Cohen. *With Diagrams.*

United Kingdom—Plymouth. *P.I. Civil Engineers* **146** (1901): 2–42. **Sandeman.**
The Burrator Works for the Water-Supply of Plymouth. By Edward Sandeman. *With Plate.*

United Kingdom—Population. *Rev. G.* **49** (1901): 548–561. **Lavagne.**
Répartition de la population en Angleterre au cours du XIX^e siècle. Par Paul Lavagne.

Vosges. *Globus* **80** (1901): 117–122. **Werner.**
Die Seen der Westvogesen. Von L. G. Werner. *With Illustrations.*

A sketch of the morphological and other features of the lakes of the Western Vosges, which are said to be in course of extinction.

ASIA.

Asia. *B.S.G. Com. Paris* **22** (1901): 284–302. **Bonin.**
De Pékin à la Mer Noire à travers l'Asie. Par M. Charles-Eudes Bonin. *Map.*

Baluchistan and Persia. *Mem. Geolog. Surv. India* **31** (1901): 179–302. **Vredenburg.**
A Geological Sketch of the Balúchistán Desert, and part of Eastern Persia. By E. Vredenburg. *With Maps and Plates.*

Though mainly geological, this opens with an instructive sketch of the external physical features of the country.

Cambodia. **Aymonier.**
Le Cambodge. Par Étienne Aymonier. 2 vols. I. Le Royaume actuel. II. Les Provinces Siamoises. Paris: E. Leroux, 1900–1901. Size 11 × 7½, pp. (vol. i.) xxiv. and 478; (vol. ii.) 482. *Maps and Illustrations. Price* 32*s.*

A full and careful description of the country, people, monuments, etc., of Cambodia and neighbouring parts of Siam, based on the author's personal observations and on the work of other travellers. The whole forms a useful compendium of our present knowledge of the countries dealt with.

Central Asia. *M.G. Ges. Wien* **44** (1901): 239–261. **Almásy.**
Reise nach West-Turkestan und in den Centralen Tiën-Shan. Von Dr. Georg v. Almásy.

Ceylon. *B.S.G. Lille* **36** (1901): 358–362. **Évrard.**
Une visite aux ruines de Pollanarouwa (Ceylan). Par A. M. Évrard, S.J.

China. ———
China. Imperial Maritime Customs. I. Statistical Series: Nos. 3 and 4. Returns of Trade and Trade Reports for the year 1900. Part II. Reports and Statistics for each Port, with Report on Foreign Trade of China. Shanghai; London: P. S. King & Son. 1901. Size 11 × 8½, pp. xxii. and 778. *Map and Diagrams. Presented by the Inspector-General of Chinese Customs.*

China. *J. School G.* **5** (1901): 263–269. **Eitel.**
Some little-known features of China. By Rev. Dr. Eitel.

China—Macao. *B.S.R.G. d'Anvers* **25** (1901): 354–359. **Jacqmin.**
Macao. Par M. L. Jacqmin. *With Illustration.*

China—Mongolia. *Tour du Monde* **7** (1901): 493–528. **Batz.**
Voyage en Mongolie. Par M. le Baron de Batz. *With Map and Illustrations.*

China—Yunnan. *Rev. G.* **49** (1901): 422–437. **Schmidt.**
Le Yun-Nan. Le chemin de fer de Lao-Kay à Yun-Nan-Sen. Par Commandant L. Schmidt. *With Map and Diagram.*

Eastern Asia. *Rev. G.* **49** (1901): 401–421. **Brissé.**
L'Allemagne en Extrême-Orient. Par André Brissé. *With Maps.*

India—Anthropology. **Fawcett.**
Madras Government Museum. Bulletin, vol. iii. No. 3. Anthropology. Nâyars of Malabar. By F. Fawcett. Madras, 1901. Size 8½ × 5½, pp. 185–322. *Illustrations. Price 2s. 3d.*

India—Assam. *J. Asiatic S. Bengal* **69** (Pt. iii.) (1900): 1–127. **Waddell.**
The Tribes of the Brahmaputra Valley. A Contribution on their Physical Types and Affinities. By L. A. Waddell. *With Plates.*

India—Historical. *J. Asiatic S. Bengal* **70** (Pt. i.) (1901): 29–30. **Hoey.**
Supplement to Note on Vaisali and other places mentioned by the Buddhist pilgrims. By W. Hoey. *With Map and Plate.*

India—Nilgiri Railway. *P.I. Civil Engineers* **145** (1901): 1–43. **Weightman.**
The Nilgiri Mountain Railway. By W. J. Weightman. *With Plate.*

India—Punjab. *J. Asiatic S. Bengal* **70** (Pt. i.) (1901): 1–6. **Maclagan.**
Abū-l-Fazl's account of the Multān Sirkār in the Third Book of the Āīn-i-Akbarī By E. D. Maclagan.

India—Sikkim. *Globus* **80** (1901): 253–259. **Bodsohn.**
Reise im unabhängigen Sikkim (Himalaja). Von P. L. Bodsohn. *Illustrations.*

India—Water-supply. *Mem. Geolog. Surv. India* **32** (1901): 1–88. **Vredenburg.**
Recent Artesian Experiments in India. By E. Vredenburg.
This was noticed in February in the Monthly Record.

Indian Ocean—Maldive and Laccadive Islands. **Gardiner.**
The Fauna and Geography of the Maldive and Laccadive Archipelagoes. Being the Account of the Work carried on and of the Collections made by an Expedition during the years 1899 and 1900. Edited by J. Stanley Gardiner, M.A. Vol. i. Part i. Cambridge: the University Press; London: C. J. Clay & Sons, 1901. Size 11¼ × 9, pp. 118. *Illustrations. Price 15s. net.*

The scientific results of the expedition described by Mr. Gardiner at the meeting of the Society on January 27 are being published in an exhaustive form in parts, of which the above is the first. The work, which promises to be a credit to the Cambridge University Press, will consist of eight parts (2 vols.) mostly devoted to the zoology of the groups, the first, however, supplying a narrative of the expedition and a valuable sketch of the general geography and structure of the islands.

Japan—Language. **Seidel.**
Grammatik der Japanischen Umgangssprache mit Uebungsstücken und Wörterverzeichnissen. Von A. Seidel. Zweite Auflage. Wien, Pest, Leipzig: A. Hartleben [not dated]. Size 7 × 4¾, pp. xii. and 178. *Price 2 m. Presented by the Publisher.*

Malay Archipelago—Borneo. **Nieuwenhuis.**
Tijds. K. Ned. Aard. Genoots. Amsterdam **18** (1901): 1013-1121.

Mededeelingen over het vervolg der commissiereis naar Centraal-Borneo. Door Dr. A. W. Nieuwenhuis. Algemeene beschouwingen en gevolgtrekkingen naar aanleiding van de commissiereis naar Centraal-Borneo van Mei 1898 tot December 1900. Door Dr. A. W. Nieuwenhuis.

Extends and continues the account of the journey referred to in vol. xviii. of the *Journal* (p. 87).

Malay Archipelago—Celebes. **Adriani.**
Tijds. Ind. Taal-, Land- en Volkenk. **44** (1901): 215-254.

Mededeelingen omtrent de Toradja's van Midden Celebes, lezing gehouden door Dr. N. Adriani, den 3 Sept. 1900.

Malay Archipelago—Sumatra. **Twiss.**
Tijds. Ind. Taal-, Land- en Volkenk. **44** (1901): 255-285.

Eenige aanteekeningen omtrent land en volk der beoosten de onderafdeeling Kotta VII. gelegen onafhankelijke landen. Door F. Twiss.

Pamir. *G. Tidskrift* **16** (1901-1902): 82-108. **Olufsen.**

Den anden danske Pamirexpedition. Ved O. Olufsen. *With Map and Illustrations.*

Philippine Islands. ——

El Archipiélago Filipino. Colección de datos geográficos, estadisticos, cronológicos y cientificos, relativos al mismo, entresacados de anteriores obras ú obtenidos con la propia observación y estudio por algunos padres de la Misión de la Compañia de Jesús en estas islas. 2 vols., and Atlas. Washington, 1900. Size 11½ × 8, atlas 15 × 13, pp. (vol. i.) xxvi. and 708; (vol. ii.) xx. and 470. *Maps, Diagrams, and Illustrations.* Price $20.

This fine work will be specially reviewed.

Russia. **Primbault.**
B.S.R.G. d'Anvers **24** (1900): 241-292, 385-446; **25** (1901): 161-232, 360-471.

Promenade au Caucase et dans le Turkestan. Par M. Henri Primbault.

Russia—Caucasia. **Krassnow.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 429-435.

Die Stellung von Kolchis in den feuchten subtropischen Gebieten der Erde. Von Prof. Andreas Krassnow.

Russia—Siberia. *Globus* **80** (1901): 101-103. **Adler.**

Die neuesten russischen Seenforschungen in Westsibirien. Von B. Adler.

Russia—Siberia. **Shokalsky.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 777-780.

Les Travaux des officiers hydrographes russes dans l'Océan Arctique et en Sibérie. Par Lieut.-Colonel Jules de Schokalsky.

Russian Central Asia. *Petermanns M.* **47** (1901): 199-202. **Woeikow.**

Die Seespiegelschwankung zwischen Aralsee und Baraba und die Brücknersche Hypothese. Von Prof. Dr. A. Woeikow.

See note in the *Journal* for November, 1901 (p. 531).

Siam. *G. Tidskrift* **16** (1901-1902): 108-121. **Mortensen.**

Fra den danske videnskabelige Siam Expedition. Af Dr. Th. Mortensen. *With Illustrations.*

Merely a popular account of the expedition.

Tibet—Lhasa. *La G., B.S.G. Paris* **4** (1901): 242-247. **Deniker.**

La première photographie de Lhassa. Par J. Deniker. *Plan and Illustrations.*

Turkey—Symi. *B.S.R.G. d'Anvers* **25** (1901): 257-274. **Hauttecœur.**

L'île de Symi. Par M. Henry Hauttecœur.

AFRICA.

Abyssinia. *La G., B.S.G. Paris* **4** (1901): 217-234. **Le Roux.**

Voyage au Ouallaga. Itinéraire d'Addis-Ababâ au Nil Bleu. Par Hugues Le Roux.

This was noticed in the Monthly Record for January (p. 87).

Africa. **Simond.**
Les Français en Afrique au XIXe Siècle. Par Charles Simond. Paris: H. E. Martin. (Not Dated.) Size 13 × 9, pp. iv. and 306. *Price* 12*s.* *Maps and Illustrations.*

An historical sketch of French activity in Africa during the nineteenth century.

Africa—Labour-supply. **Negreiros.**
La Main-d'Œuvre en Afrique. Mémoire présenté au Congrès Colonial International de 1900 à Paris, à la Séance du 3 Août. Par A. d'Almada Negreiros. Paris: A. Challamel, 1900. Size 9 × 6, pp. 36. *Presented by the Author.*

Africa—Medical Geography. *Rev. Française* **26** (1901): 625–639. **Servigny.**
La mission Marchand au point de vue médical. Par J. Servigny.

Africa—Research. *J. African S.* (1901): 17–22. **Johnston.**
Notes on African Subjects of Special Interest. By Sir H. H. Johnston, K.C.B.

A sketch of the various departments of science in which research is needed in Africa.

Africa—Survey. ———
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 744–745.
Topographical Survey of Africa. Abstract of the Report of Permanent Bureau. *Map.*

Africa—Tsetse Fly Disease. **Koch.**
Ein Versuch zur Immunisirung von Rindern gegen Tsetsekrankheit (Surra). Von R. Koch. (Beilage zum "Deutschen Kolonialblatt," XII. Jahrang, Nr. 24. Berlin, den 15 December, 1901.) Size 10½ × 7¼, pp. 4.

Gives details of successful inoculation in the case of two oxen, which, when subject to lengthened tests, have shown themselves completely immune from the tsetse fly disease. The author, however, considers the question still far from settled.

African Islands. *A travers le Monde, Tour du Monde* **8** (1902): 21–22. **Kadoré.**
Juan de Nova et Europa. Deux îlots français du canal de Mozambique. Par Pierre de Kadoré. *With Map.*

Cape Colony. **Gill.**
Report of His Majesty's Astronomer at the Cape of Good Hope, to the Secretary of the Admiralty, for the year 1900. London: Printed by Eyre & Spottiswoode, 1901. Size 12½ × 10, pp. 22.

See note in Monthly Record for January (p. 90).

Central Africa. **Götzen.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 759–766.
Ueber die neuesten Forschungen im Gebiet der Nil-Quellen. Von A. Graf von Götzen.

Congo State. *Mouvement G.* **18** (1901): 523–527. **[Wauters.]**
Exploration de la section Septentrionale de la chaîne des Mitumba le long des lacs Tanganika et Kivu. *With Map.*

This is the account of the journey of MM. Sillye and Siffer referred to in the *Journal* for December (p. 622).

East Africa. *J. African S.* (1901): 98–125. **Hollis.**
Notes on the History and Customs of the People of Taveta, East Africa. By Claud Hollis. *With Illustrations.*

East Africa. **Schoeller.**
Mitteilungen über meine Reise nach Äquatorial-Ost-Afrika und Uganda, 1896–1897. Von Dr. Max Schoeller. Band I. und Band III. (Maps). Berlin: Dietrich Reimer (Ernst Vohsen), 1901. Size 11 × 7½, pp. 262 and 28. *Plates. Presented by the Author.*

This important work will be reviewed elsewhere.

East Africa. **Velten.**
Schilderungen der Suaheli von Expeditionen v. Wissmanns, Dr. Bumillers, Graf v. Götzens, und Anderer. Aus dem Munde von Suaheli-negern gesammelt u. übersetzt von Dr. C. Velten. Göttingen: Vandenhoeck & Ruprecht, 1901. Size 8½ × 5½, pp. 308.

This interesting little book gives for the first time narratives of African travel from point of view of Swahili members of exploring expeditions. Dr. Velten has taken them down in Swahili from the mouths of the narrators, and here presents them to the German public, the Swahili text being published simultaneously.

East Africa—Glaciation. **Meyer.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 767–773.
Heutige und einstige Vergletscherung im tropischen Ost Afrika. Von Prof. Dr. Hans Meyer.

Egypt. **Baedeker.**
Egypt. Handbook for Travellers, edited by Karl Baedeker. Fifth Edition. Leipsic: Karl Baedeker, 1902. Size 6½ × 4½, pp. cxcii. and 408. *Maps, Plans, and Illustrations. Presented by the Editor.*

In this edition the two volumes devoted previously to Lower and Upper Egypt have been wisely compressed into one by judicious curtailment. Maps have been added of the Fayum and of the Nile from Cairo to Assuan, as well as various town plans.

Egypt—Fayûm. *Geolog. Mag.* 8 (1901): 540–546. **Beadnell.**
The Fayûm Depression: A Preliminary Notice of the Geology of a District in Egypt containing a new Palæogene Vertebrate Fauna. By Hugh J. L. Beadnell.

Egypt—Nile. **Claparède.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 748–758.
De quelques particularités de la première et de la seconde Cataracte du Nile. Par Dr. Arthur de Claparède.

Egypt—Nile Reservoir. **Claparède.**
Verh. Siebenten Internat. G. Kongresses 2 (1899): 538–544.
Note sur le grand Barrage du Nil au dessous d'Assouan. Par Dr. Arthur de Claparède.

Egypt—Railways. *P.I. Civil Engineers* 145 (1901): 256–267. **Peacock.**
Light Railways in Egypt. By J. A. W. Peacock. *With Plate.*

Egypt—Suez Canal. **Roux.**
L'Isthme et le Canal de Suez, historique, état actuel. Par J. Charles-Roux. 2 vols. Paris: Hachette et Cie., 1901. Size 10½ × 7, pp. (vol i.) iv. and 516; (vol. ii.) 550. *Maps and Illustrations.*

A carefully compiled work, presenting, from a great variety of sources, the history of the Isthmus of Suez, and all attempts at its canalization, from the time of the ancient Egyptians to the present day.

French Congo. *Questions Dipl. et Colon.* 12 (1901): 586–604. **Aspe-Fleurimont.**
Le Congo français. Une expérience coloniale. Par M. Aspe-Fleurimont.

On the attempt to develop the territory by means of commercial concessions.

French Guinea. *B. Union G. Nord de la France* 22 (1901): 22–43. **Noirot.**
La Guinée française et le Fouta-Djalon. Par M. Noirot.

German Colonies. *J. African S.* (1901): 23–38. **Wright.**
German Methods of Developement in Africa. By C. T. Hagberg Wright.

Contains much detailed information as to the constitution and methods of operation of German Colonial Companies.

German East Africa. ———
Magila in Picture. A series of Illustrations of the Places and People in the Usambara District, East Central Africa, chiefly in connexion with the Work of the Universities' Mission to Central Africa. London: Office of the Universities' Mission to Central Africa, 1901. Size 7 × 8½, pp. 80. *Map and Illustrations.. Price 1s. 9d. Presented by the Universities' Mission.*

Ivory Coast. *Rev. G.* 49 (1901): 452–460. **D'Ollone.**
Les populations Anthropophages du Cavally. Par Capitaine D'Ollone.

Ivory Coast. **Thomann.**
Renseignements Colon., Comité l'Afrique Française, Nos. 6 and 7 (1901): 113–156.
A la Côte d'Ivoire: La Sassandra. Par M. Georges Thomann. *With Map.*

A sketch of the geography and ethnology of the Ivory Coast, with accounts of the author's own journeys, extending over several years.

Kamerun. *Deutsch. Kolonialzeitung* 18 (1901): 465–467. **Schulte.**
Zur Eisenbahn Victoria-Mundame. Von Dr. A. Schulte. *With Map.*

Kamerun. *Deutsch. Kolonialblatt* 12 (1901): 742–746. **Stein.**
Expedition des Freiherrn v. Stein.

This is the subject of a note in the Monthly Record (*ante*, p. 218).

Kamerun. *Deutsch. Kolonialblatt* 12 (1901): 741–742. ——
Stationsanlage am Crossfluss. *With Sketch-map.*

Liberia. *Questions Dipl. et Colon.* 12 (1901): 523–531. **Franklin.**
La question de Libéria. Par J. H. Franklin. *With Map.*

Morocco. *La G., B.S.G. Paris* 4 (1901): 235–241. **Weissgerber.**
Itinéraire de Casablanca aux Beni-Meskin. By Dr. F. Weissgerber. *With Map.*

Niger. *B. Comité l'Afrique Française* 11 (1901): 334–336. **Lenfant.**
La navigation du Niger: La flottille du Capitaine Lenfant.

This was noticed in the *Journal* for December (p. 623).

Niger. *Rev. Française* 26 (1901): 640–644. **Lenfant.**
La montée du Niger: Mission Lenfant.

Nigeria—Benin. **Luschan.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 607–612.
Ueber die alten Handelsbeziehungen von Benin. Von Prof. Dr. F. von Luschan.

Portuguese East Africa. *J. African S.* (1901): 126–144. **Spilsbury.**
Expedition from Port Amelia to Lake Nyassa, commanded by Major Spilsbury. *With Map and Plan.*

As far as the Lujenda, Major Spilsbury's route coincided in the main, though with some deviations, with that followed in the reverse direction by Mr. J. T. Last in 1886. The spelling of place-names is unsystematic.

Sahara. *Rev. Scientifique* 16 (1901): 721–723. **Bonnard.**
A propos du Transsaharien. Par Paul Bonnard. *With Map.*

The author favours a line from Bizerta and Bughara to Lake Chad.

Sahara. **Foureau.**
Mission Saharienne Foureau-Lamy. D'Alger au Congo par le Tchad. Par F. Foureau. Paris: Masson et Cie., 1902 [1901]. Size 9 × 6½, pp. 12 and 832. *Map and Illustrations. Presented by the Author.*

A review of this work appeared in the February number.

South Africa—Kalahari. **Passarge.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 774–776.
Die Hydrographie des nördlichen Kalahari-Beckens. Von Dr. Siegfried Passarge. *With Map.*

Tripoli. **Minutilli**
F. Minutilli. La Tripolitania. Torino: Fratelli Bocca, 1902 [1901]. Size 8½ × 5, pp. viii. and 438. *Map. Presented by the Publisher.*

A useful summary of existing knowledge on Tripoli and its Hinterland, with notes on the people, industries, commerce, the history of the country, etc., etc.

Tunis—Farming. **Beaumont.**
A Travers le Monde, Tour du Monde 7 (1901): 281–284, 345–348, 353–356.
Les grands Domaines franco-tunisiens. Par G. de Beaumont. *With Illustrations.*

On recent attempts to introduce improved methods of farming in Tunis.

West Africa—Fetishism. *B. American G.S.* 33 (1901): 305–317. **Nassau.**
Fetishism, a Government. By R. H. Nassau.

Describes the working of fetishism in the Corisco bay region from long experience as a missionary.

West Africa—Frontiers. *B. Comité l'Afrique Française* 11 (1901): 368–371. ——
Une violation de la frontière entre le Cameroun et le Congo. *With Map.*

Stations established by the Germans on the north bank of the Ngoko in accordance with Dr. Pleyn's mapping of the frontier are said to be really in French territory.

West Africa—Native Law. *J. African S.* (1901): 80–97. **Stopford.**
Glimpses of Native Law in West Africa. By Colonel J. G. B. Stopford.

West Africa—Trade. *J. African S.* (1901): 40–63. **Root.**
British Trade with West Africa. By J. W. Root.

NORTH AMERICA.

Alaska—Cape Nome. *Globus* 80 (1901): 333–334. ——
Das Goldgebiet am Kap Nome.

America—Cartography. **Phillips.**

Library of Congress. Division of Maps and Charts. A List of Maps of America in the Library of Congress, preceded by a list of works relating to Cartography. By P. Lee Phillips. Washington: Government Printing Office, 1901. Size $11\frac{1}{2} \times 7\frac{1}{2}$, pp. 1138. *Two copies, one presented by the Library of Congress, the other by R. B. Marston, Esq.*

This catalogue will be of much value to students of historical cartography. The arrangement is primarily a subject one, but is chronological within the separate headings. The list includes maps in books and atlases, many manuscript maps, especially of the Revolutionary war, unknown to historians, and a large number of old state and county maps and plans of cities. The attention called to these will thus make many of them available to students for the first time. As regards originals of early maps, the collection is not particularly rich, but references are given to reproductions under the date of the original map. No such references are, however, given either to Kretschmer's atlas, or to the important series of reproductions published by Leroux of Paris in 1893, both of which refer specially to America, and are in the Library of Congress, as appears from the list of works on cartography which precedes the topographical list. Thus the latter contains no entry relating to the Canerio map (1502), of which a reproduction is given in the French collection.

Mexico. *B.S.R.G. d'Anvers* **25** (1901): 299–341. **George.**

Une excursion à travers le Mexique. Par M. Louis George. *With Illustrations.*

North America. **Herbertson.**

Descriptive Geographies from Original Sources. North America. Selected by F. D. Herbertson, B.A. Edited with Introduction by A. J. Herbertson, PH.D. London: A. & C. Black, 1901. Size 7 × 5, pp. xxxvi. and 252. *Illustrations. Price 2s. Presented by the Author.*

One of a series in course of preparation, which should prove of much value from an educational point of view. It aims at providing the student with the personal descriptive element in regard to distant countries, which is not to be found in ordinary text-books, but is essential to a real grasp of the characteristic features of the regions studied. The vast mass of modern literature makes it impossible for the teacher or pupil to draw at first hand from the actual accounts of travellers, but the necessary material is here supplied by a judicious selection of passages of most value for purposes of description, reinforced by illustrations of typical features. The main outlines of the geography are summed up in an introduction to each volume.

United States. *B. American G.S.* **33** (1901): 301–304. **Wilson.**

Topographic Forms of the United States. By Herbert M. Wilson.

Shows how the various topographic forms are illustrated in the maps of the U.S. Geological Survey.

United States—Boundaries. **Moore.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 691–703.

Boundaries of the United States. By Prof. John Bassett Moore.

United States—Colorado. *La G., B.S.G. Paris* **4** (1901): 339–351. **Davis.**

Les Enseignements du Grand Canyon du Colorado. Par W. M. Davis. *With Illustrations.*

Professor Davis's deductions respecting the geological history of the Colorado cañon were summarized in the *Journal* for December (p. 624).

United States—Ethnology. **Powell.**

Seventeenth Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution. 1895-96. By J. W. Powell, Director. Part 2. Washington, 1898. Size $11\frac{1}{2} \times 8$, pp. 475–752. *Maps and Illustrations. Presented by the Bureau of American Ethnology.*

Contains a description (with map) of the Navaho Indians of Arizona and New Mexico, their country and houses, by Cosmos Mindeleff; and a full account of the Arizona Archæological Expedition of 1895, by J. W. Fewkes.

United States—Geological Survey. ———

Twentieth Annual Report of the United States Geological Survey to the Secretary of the Interior, 1898–1899. In Seven Parts. Part ii. General Geology and Paleontology (pp. 954). Part iii. Precious Metal Mining Districts (pp. 596). Part iv. Hydrography (pp. 660). Part v. Forest Reserves (pp. 498). Maps in separate case. Washington, 1900. Size $11\frac{1}{2} \times 8$. *Maps and Plates. Presented by the U.S. Geological Survey.*

United States—Missouri River. **Owen.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901), 686-690.
The Bluffs of the Missouri River. By Miss Luella Agnes Owen.

United States—Ohio. *Science* **14** (1901): 775-776. **Tight.**
Preglacial Drainage in South-Western Ohio. By W. G. Tight.

The writer supports the deductions lately made by Mr. Fowke as against the criticisms of Prof. A. M. Miller.

United States—Population. *B. American G.S.* **33** (1901): 348-349. **Gannett.**
The Population of the United States by Sex, Nativity, and Race. By Henry Gannett.

United States—Texas. *Science* **14** (1901): 326-328. **Hill.**
The Coast Prairie of Texas. By R. T. Hill.

The writer's observations lead him to believe that between the Trinity and Colorado rivers the Texas plain is rising.

United States—Washington. *Ann. Hydrographie* **29** (1901): 483-502. ———
Die Puget-Sund-Häfen.

CENTRAL AND SOUTH AMERICA.

Argentine Republic. *B. Démograph. Argentin* **2** (1901): 45-68. **Carrasco.**
Cálculo de la población probable de la República al entrar al siglo XX. Por G. Carrasco.

The total population on December 31, 1900, is estimated at 4,794,149.

Argentine Republic. *B.S.G. Italiana* **2** (1901): 995-997. **Gelodi.**
Sulla colonizzazione della Repubblica Argentina. Da una lettera dell' Ing. E. C. Gelodi al socio dott. A. Baldacci.

Argentine Republic. **Hauthal.**
Publicaciones de la Universidad de La Plata. Contribuciones al Conocimiento de la Geologia de la Provincia de Buenos Aires. I. Excursión á la Sierra de la Ventana. II. Apuntes Geológicos de las Sierras de Olavarria. Por Rodolfo Hauthal. No. 1—Julio 1901. La Plata, 1901. Size 10½ × 7, pp. 30. *Map and Illustrations. Presented by the Facultad de Ciencias Fisico-Matematicas de la Universidad de La Plata.*

Argentine Republic. ———
Ministerio de Agricultura. Memoria presentada al Honorable Congreso, Enero de 1899—Octubre de 1900. Buenos Aires, 1900. Size 10½ × 7½, pp. cxxxii. and 670. *Diagrams. Presented by Dr. F. P. Moreno.*

Argentine Republic—Archæology. **Quiroga.**
Adan Quiroga. La Cruz en America (Arqueologia Argentina) Con un prólogo de Samuel A. Lafone Quevedo. Buenos Aires, 1901. Size 9½ × 6½, pp. xxiv. and 280. *Illustrations.*

Brazil. *Export* **23** (1901): 621-623. ———
Die São-Paulo-Ribeira-Bahn. *With Sketch-map.*

Brazil. *Mouvement G.* **18** (1901): 427-430. ———
L'exploitation du haut Guapore. *With Map.*

A Belgian commercial company has obtained a concession on the right banks of the Guapore and Mamore, and is studying the question of the opening of a route *viâ* the Paraguay.

Ecuador—La Plata Island. **Dorsey.**
Archæological Investigations on the Island of La Plata, Ecuador. By George A. Dorsey. (Field Columbian Museum, Publication 56. Anthropological Series, vol. ii., No 5.) Chicago, 1901. Size 10 × 6½, pp. 245-280. *Maps and Illustrations.*

Guatemala. *Globus* **80** (1901): 281-284. **Buhle.**
Das Deutschtum in Guatemala. Von Heinz Buhle.

Haiti. *Petermanns M.* **47** (1901): 193-199. **Tippenhauer.**
Beiträge zur Geologie Haïtis. Von L. Gentil Tippenhauer. VI. Das Lignitlager von Maïssade und der Aufstieg zum Zentralplateau von Gonaïves und von Norden aus. *With Map and Plate.*

Magellan Strait. **Nordenskjöld.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 303–306.
Die Landschaftsformen der Magellan-Länder mit besonderer Rücksicht auf die glacialen Bildungen. Von Dr. Otto Nordenskjöld.

Nicaragua. **Davis.**
Hydrography of Nicaragua. By Arthur P. Davis.—Twentieth Annual Report of the U.S. Geological Survey, 1898–99. Part iv. Pp. 563–637. *Map and Plates.*

Includes an investigation into the ship-transit problem, and report on the work of the Nicaragua Canal Commission of 1898.

Paraguay. **Graham.**
A Vanished Arcadia, being some account of the Jesuits in Paraguay, 1607 to 1767. By R. B. Cunninghame Graham. London: William Heinemann, 1901. Size 9 × 6, pp. xvi. and 294. *Map. Price 9s.*

Peru. **Haënke.**
Descripcion del Peru. Por Tadeo Haënke. Lima, 1901. Size 9½ × 6½, pp. xiv. and 320. *Portrait.*

Peru. **Moreno.**
Perú. Las Irrigaciones de la Costa. Estudio . . . por Federico Moreno. Lima, 1900. Size 8 × 6, pp. 226.

Peru. **Portillo.**
Las Montañas de Ayacucho y los rios Apurimac, Mantaro, Ene, Perené, Tambo y alto Ucayali. Por el Coronel D. Pedro Portillo. Lima, 1901. Size 11 × 7½, pp. 8 and 136. *Maps and Illustrations.*

Peru. **Sala.**
República del Perú. Ministerio del Fomento. Apuntes de Viaje del R. P. Fr. Gabriel Sala. Exploracion de los Rios Pichis, Pachitea y alto Ucayali y de la región del Gran Pajonal. Lima, 1897. Size 9 × 6½, pp. viii. and 196. *Map and Illustrations.*

Venezuela and British Guiana. **Baker.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 704–706.
Geographical Results of the Venezuela-British Guiana Boundary Dispute. By Marcus Baker.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia. *Verh. Ges. Erdk. Berlin* 28 (1901): 405–421. **Wiedemann.**
Herr Dr. Max Wiedemann, Ergebnisse einer wirtschaftgeographischen Studienreise nach Australien.

Australia. **Wragge.**
Suggestions for the Establishment of a Federal Weather Bureau for the Commonwealth of Australia. By Clement L. Wragge. [1 Sheet.] Size 13½ × 8½.

Australia—Ancient Wreck. **Thomson.**
R.G.S. Australasia (*Victoria*) 19 (1901): 83–84.
Notes *re* the Supposed Ancient Wreck near Warrnambool. By Captain Wm. C. Thomson.

Old Spanish and Dutch coins of dates 1717 and 1792 have been found near the scene of the wreck, of the history of which nothing is known.

Australia—Capital. ——
New South Wales. Report of the Commissioner on Sites for the Seat of Government of the Commonwealth. Sydney, 1900. Size 13 × 8½, pp. vi. and 96. *Map.*

This was noticed in the *Journal* for November last (p. 538).

Australia—Capital. *R.G.S. Australasia* (*Victoria*) 19 (1901): 30–38. **Gipps.**
Lake George (New South Wales) as a Site for the Federal Capital of Australia. By F. B. Gipps.

Australia—Water Supply. **McKinney.**
J. and P.R.S. New South Wales 34 (1900): 233–255.
Intercolonial Water Rights as affected by Federation. By H. G. McKinney. *With Map.*

Eastern Pacific. **Pallander.**

The Log of an Island Wanderer. Notes of Travel in the Eastern Pacific. By Edwin Pallander. London: C. Arthur Pearson, 1901. Size 8 × 5½, pp. 320. *Illustrations. Price 6s. Presented by the Publisher.*

A popular account of visits to Barotonga, Tahiti, the Marquesas, and other lands of the Eastern Pacific.

Pacific—Nomenclature. **Luschan.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 393–396.

Vorschläge zur geographischen Nomenklatur der Südsee. Von Prof. Dr. F. von Luschan.

Queensland—Brisbane River. *P.J. Civil Engineers* **145** (1901): 334–339. **Williams.**

On Some Effects of Land Floods in a Tidal River. By C. J. R. Williams. *With Plate.*

South Australia—Northern Territory. **Parsons and Holtze.**

The Northern Territory of South Australia, a brief historical account: pastoral and mineral resources. By the Hon. J. Langdon Parsons. The Capabilities of the Northern Territory for Tropical Agriculture. By Maurice W. Holtze. (Papers read before the Royal Geographical Society of Australia, South Australian Branch.) Adelaide, 1901. Size 8½ × 5½, pp. 28. *Map and Illustrations. Presented by the Royal Geographical Society of Australia, South Australian Branch.*

See note, *ante*, p. 378.

POLAR REGIONS.

Antarctic—Auroras. *Ciel et Terre* **22** (1901): 79–91, 113–123. **Arçtowski.**

Sur les variations périodiques des aurores australes observées à bord de la "Belgica." Par H. Arçtowski. *With Diagrams.*

Antarctic—Belgian Expedition. **Arçtowski and Thoulet.**

Expédition Antarctique Belge. Résultats du Voyage du S.Y. Belgica en 1897–1898–1899 sous le commandement de A. de Gerlache de Gomery. Rapports Scientifiques publiés aux frais du Gouvernment Belge, sous la direction de la Commission de la Belgica. Océanographie. Rapport sur les densités de l'eau de mer observées à bord de la Belgica. Par H. Arçtowski et J. Thoulet. Anvers: J. E. Buschmann, 1901. Size 13 × 11, pp. 24. *Map and Illustrations. Presented by M. J. Thoulet.*

This is the first part received by the Society of the scientific results of the voyage of the *Belgica*. The style of the publication is all that could be desired.

Antarctic—German Expedition. **Drygalski.**

Verh. Ges. Erdk. Berlin **28** (1901): 361–363.

Die Deutsche Südpolar-Expedition. Von Prof. Dr. Erich v. Drygalski.

Antarctic—Ice. **Fricker.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 348–353.

Das Treibeis der antarktischen Meere. Von Dr. Karl Fricker.

Antarctic—Scottish Expedition. **Bruce.**

The Scottish National Antarctic Expedition. By W. S. Bruce. Read at the British Association Meeting, Glasgow, 13th September, 1901. Size 11 × 9½, pp. 10. *Map.* (See also *Scottish G. Mag.* **17** (1901): 561–569.)

Arctic. **Dittmer.**

Das Nord-Polarmeer. Nach Tagebüchern und Aufnahmen während der Reise mit Sr. Maj. Schiff "Olga." Von R. Dittmer. Herausgegeben vom Deutschen Seefischerei-Verein. Hannover und Leipzig: Hahn'sche Buchhandlung, 1901. Size 9½ × 6½, pp. xvi. and 362. *Map and Illustrations. Price 6s.*

Arctic—Andrée's Expedition. *Globus* **80** (1901): 144–145. **Voigt.**

Wann erfolgte der Untergang der Andréeschen Polarexpedition? Von Dr. Eric Voigt.

The writer thinks that, weighed down by the ice which accumulated during a five-days' snowstorm, the balloon stranded between July 16 and 20, 1897, between Spitsbergen and Franz Josef Land.

Arctic—Currents. **Bryant.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 663–667.

Drift Casks to determine Arctic Currents. By Henry G. Bryant.

Arctic—Ice. *Verh. Siebenten Internat. G. Kongresses*, 1899, **2** (1901): 343–347. **Garde.**
Die Verbreitung des Treibeises in den arktischen Meeren, nach den Arbeiten des Dänischen Meteorologischen Instituts. Von T. V. Garde.

Arctic—Meteorology. ———
Meteorological and Hydrological Observations, summer of 1898, by the Expedition of Colonel Vilkitzky to the Arctic Ocean. Published by the Chief Hydrographic Department. [In Russian.] St. Petersburg, 1900. Size 11 × 9, pp. vi., 38, and 4.
Ditto, Ditto for summer of 1899. Size 11 × 9, pp. viii. and 58. *Map.*

Arctic—Nansen's Expedition. **Cora.**
Cosmos **12** (1894–96): 212–224, 367–375; **13** (1901): 70–91.
La Spedizione Artica di Fridtjof Nansen (1893–96). Notizie e riflessi di Guido Cora. *With Map.*

Arctic—Norwegian Expedition. **Mohn.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 668–670.
Ergebnisse der meteorologischen Beobachtungen der Norwegischen Polar-Expedition mit der "Fram" 1893–1896. Von Prof. Dr. H. Mohn.

Greenland. **Steenstrup**
Beretning om en Undersøgelsesrejse til Øen Disco Sommeren 1898. Af K. J. V. Steenstrup.—Meddelelser om Grønland, udgivne af Commissionen for Ledelsen af de geologiske og geographiske Undersøgelser i Grønland. 24[nde] Hefte, pp. 251–321. Kjøbenhavn: C. A. Reitzel, 1901. *Maps and Plates. Also separate copy, presented by the Author.*
This is noticed in the Monthly Record (p. 379).

Polar flora. *Die Natur* **50** (1901): 510–512. **Holm.**
Die Flora der "ewigen Schnee- und Eis- Region." Von Herm. Holm.

Spitzbergen—Glaciers. **Geer.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 299–302.
Die Gletscher von Spitzbergen. Von Prof. Gerard de Geer.

MATHEMATICAL GEOGRAPHY.

Cartography. *B.S.Bretonne G.* **19** (1901): 77-89. **Olivier.**
La Cartographie en 1900. Par Edouard Olivier.

Cartography. **Frassi.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 113–119.
La Nouvelle Cartographie Horaire. Par le Prof. Henri Frassi.

Cartography. **Oberhummer.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 85-98.
Ueber Hochgebirgs-Karten. Von Prof. Dr. Eugen Oberhummer.

Cartography. *Verh. Siebenten Internat. G. Kongresses*, 1899, **2** (1901): 65–71. **Penck.**
Ueber die Herstellung einer Erdkarte im Maassstab 1 : 1,000,000. Von Prof. Dr. Albrecht Penck.

Cartography—Methods. **Claparède.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 941-945.
Un nouveau Procédé de Construction des Reliefs, employé par Mr. C. Perron, cartographe à Genève. Communication du Arthur de Claparéde.

Geodesy. *Verh. Siebenten Internat. G. Kongresses*, 1899, **2** (1901): 27–31. **Fuss.**
Tafel zur Berechnung der Höhe und des Azimuts der Gestirne. Von V. von Fuss.

Geodesy. *Verh. Siebenten Internat. G. Kongresses*, 1899, **2** (1901): 5–15. **Helmert.**
Neuere Fortschritte in der Erkenntniss der mathematischen Erdgestalt. Von Prof. Dr. F. R. Helmert.

Geodesy. *Verh. Siebenten Internat. G. Kongresses*, 1899, **2** (1901): 16–17. **Shokalsky.**
Sur les Observations du Pendule à seconde en Russie. Par J. de Schokalsky.

Geographical Distances. **Cleeve.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 954–964.
A System of Comparing Geographical Distances. By Major Fredk. J. S. Cleeve. *With Maps.*

Latitude Variation. **Albrecht.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 18–26.
Die Veränderlichkeit der geographischen Breiten. Von Prof. Dr. Th. Albrecht.

Map Projections. **Stromeyer.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 99–109.
Surface Equivalent Projections. By C. E. Stromeyer. *With Plate.*

Marine Surveys. ———
Annali Idrografici. Raccolta di Documenti e Notizie circa l' Idrografiá e la Navigazione. Pubblicati per cura dell' Istituto Idrografico della R. Marina. Volume 2°, Anno 1901. Genova, 1901. Size 11½ × 8, pp. 130. *Charts and Plates. Presented by the R. Istituto Idrografico, Genoa.*

Contains reports on marine surveys executed by Italian vessels in various parts of the world.

Movement of the Pole. *G. Tidskrift* **16** (1901–1902): 121–124. **Engell.**
Den terrestriske Nordpols Variation. Af Dr. M. C. Engell.

Surveying Instrument. **Schrader.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 110–112.
Le Tachéographe. Par M. Franz Schrader. *With Diagram.*

Time and Azimuth. *Ann. Hydrographie* **29** (1901): 511–519. **Schrader.**
Die Bestimmung von Ortszeit und Azimut aus gleichen Sonnenhöhen. Von Dr. C. Schrader.

On a shortened method rendered possible by the use of new tables given in the *Nautische Jahrbuch* for 1903.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Acoustic Phenomena. *Sitz. A.W. München Journal* (1901): 211–263. **Günther.**
Akustisch-Geographische Probleme. Von Siegmund Günther.

In this second instalment of his study of natural acoustic phenomena (cf. *Journal*, vol. xviii. p. 114), the author discusses fully, first the musical notes given forth by valleys, woods, rocks, etc., and secondly, simple detonations, such as those associated with earthquakes.

Arid Regions. **Hilgard.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 555–561.
Characteristics of Soils in the Arid Regions. By E. W. Hilgard.

Cosmogony. *Petermanns M.* **47** (1901): 217–225. **Ratzel.**
Die Kant-Laplacesche Hypothese und die Geographie. Von Prof. Dr. Friedrich Ratzel.

The writer considers that the Kant-Laplace, or more correctly the Laplace, hypothesis cannot be considered the sole possible explanation of existing conditions from the point of view of geography.

Cosmography. *P.R. Irish A.* **6** (1901): 457–464. **Close.**
Remarks on a Cosmographical Tractate in the Irish Language in the Library of the Royal Irish Academy. By Rev. Maxwell H. Close.

The existing manuscript is in great part an Irish version of a work by Messahalah, a Jew of Alexandria (eighth century).

Dust-rain. *Sitzb. A.W. Berlin* (1901): 612–613. **Klein.**
Resultate der Untersuchung der Proben des am 10. bez. 11. März 1901 in Italien, Österreich und Deutschland gefallenen Staubregens. Von C. Klein.

Geology—Laterite. **Lenz.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 241–245.
Zur Lateritfrage. Von Prof. Dr. Oskar Lenz.

Geology and Palæontology. **Zittel.**
History of Geology and Palæontology to the end of the Nineteenth Century. By Karl Alfred von Zittel. Translated by Maria M. Ogilvie-Gordon. London: Walter Scott, 1901. Size 7½ × 5, pp. xiv. and 562. *Portraits. Price 6s. Presented by the Publisher.*

The original work was brought out in Germany in 1899, having been first entrusted by the Bavarian Academy of Sciences to Julius Ewald of Berlin, and after his death to

the present author. It has been slightly abridged in the translation, but supplies a useful sketch of the progress of geological science from its first beginnings onwards, not only in Germany, but in other countries also.

Geomorphology. **Davis.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 221–231.
The Geographical Cycle. By Prof. W. M. Davis.

Geomorphology. **Lapparent.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 213–220.
La Question des Pénéplaines envisagée à la lumière des faits géologiques. Par M. A. de Lapparent.

Glaciers. **Finsterwalder and Muret.**
Commission Internationale des Glaciers. Les variations périodiques des Glaciers. Sixième Rapport, 1900, rédigé par le Dr. Finsterwalder et E. Muret. (Extrait des *Archives des Sciences physiques et naturelles*, t. xii., 1901.) Genève: Georg & Cie, 1901. Size 9 × 6, pp. 28.

Ice Caves. *Monthly Weather Rev.* 29 (1901): 366–371. **Kimball.**
Ice Caves and Frozen Wells as Meteorological Phenomena. *Also separate copy, presented by the Author.*
This was noticed in February in the Monthly Record.

Limnology. **Halbfass.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 246–251.
Systematische internationale Seenforschung. Von Dr. W. Halbfass.

Limnology. *La G., B.S.G. Paris* 4 (1901): 108–119, 172–189. **Rabot.**
Revue de Limnologie, 1900–1901. Par Charles Rabot. *Also separate copy, presented by the Author.*

Limnology—Seiches. **Forel**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 255–258.
Les Seiches des Lacs. Par le Prof. Dr. A. Forel.

Meteorology—Methods. **Wrangell.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 367–369.
Methode zur bequemeren Messung von Serial-Temperaturen. Von F. Baron von Wrangell.

Oceanography—Baltic Sea. **Westphal.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 53–64.
Das Mittelwasser der Ostsee. Von Prof. Dr. A. Westphal. *With Diagrams.*

Oceanography—Deposits. **Thoulet.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 354–364.
Classification des Fonds sous-marins et considérations relatives à la construction d'une carte lithologique des côtes de France. Par le Prof. J. Thoulet.

Oceanography—Nomenclature. **Krümmel.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 379–386.
Die Einführung einer einheitlichen Nomenklatur für das Bodenrelief der Oceane. Von Prof. Dr. O. Krümmel.

Oceanography—Nomenclature. **Mill.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 387–392.
On the Introduction of a Systematic International Terminology and Nomenclature for the forms of Sub-Oceanic Relief. By Dr. Hugh Robert Mill.

Oceanography—Pola Expedition. **Natterer.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 326–333.
Ueber chemisch-geologische Arbeiten der "Pola" Expeditionen. Von Prof. Dr. K. Natterer.

Oceanography—Tides. **Börgen.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 132–147.
Ueber den gegenwärtigen Stand der Gezeitenforschung und die Nothwendigkeit ihrer Ausdehnung auf den freien Ocean. Prof. Dr. C. Börgen.

Phyto-geography. **Drude.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 439–441.
Ueber die Ausbildung der pflanzengeographischen Kartographie. Von Prof. Dr. Oscar Drude.

Phyto-geography. **Warburg.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 442–448.
Einführung einer gleichmässigen Nomenklatur in der Pflanzengeographie. Von Prof. Dr. O. Warburg.

Rivers. *P.I. Civil Engineers* **146** (1901): 216–222. **Hearson.**
A Comparison of the Flow of Water in a River with that in a Small-Scale Model of the River. By T. A. Hearson.

Terrestrial Magnetism. **Tillo.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 129–131.
Sur la Relation qui existe entre la Repartition des Éléments magnétiques et la Distribution générale des Mers et de la Température moyenne à la surface du Globe. Par Lieutenant-General Dr. A. de Tillo.

Tidal Phenomena. *B. American G.S.* **33** (1901): 318–324. **Brownlie.**
The Solution of the Problem of the Tidal Bore. By Alexander Brownlie.

The writer puts forward a theory based on his observations on the bore of the Petitcodiac, New Brunswick.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Ancient Geography—Ptolemy. **Müller.**
Claudii Ptolemæi Geographia e codicibus recognovit, prolegomenis, annotatione, indicibus, tabulis instruxit Carolus Müllerus. Voluminis primi pars secunda. Paris: A. Firmin-Didot, 1901. Size 10½ × 7¼, pp. 571–1023.

Claudii Ptolemæi Geographia. Tabulæ xxxvi. a Carolo Mullero instructæ. Paris: Firmin-Didot, 1901. Size 15½ × 12.

Students of ancient geography will welcome the appearance of a second part of Müller's Ptolemy, the first of which was issued so far back as 1883. The work has been taken up, since the original editor's death, by Dr. C. T. Fischer, but the greater part of the notes in the present part are still by Müller. It embraces books 4 and 5 of the geography, dealing with Africa and Western Asia. The atlas gives a useful comparative view of Ptolemy's geography of the various countries side by side with the modern maps.

Anthropogeography. **Meitzen.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 483–497.
Die verschiedene Weise des Uebergangs vom Nomadenleben zur festen Siedelung bei Kelten, Germanen und Slaven. Von Prof. Dr. Auguste Meitzen. *With Plates.*

Commercial Geography. **Adams**
A Text-Book of Commercial Geography. By Cyrus C. Adams. New York: D. Appleton and Co., 1901. Size 8 × 5½, pp. xvi. and 506. *Maps and Illustrations. Presented by the Publishers.*

The main facts and principles of commercial geography are here clearly put forward, especial prominence being given to the commercial relations of the United States, the book being primarily intended for use in America. Considerations of space have perhaps led in parts to too great compression, and the treatment of African commerce is hardly adequate. On the whole, however, the facts are well up to date.

Commercial Geography—Pearl Fisheries. **Collett and Donnan.**
J. Ceylon Br. R. Asiatic S. **16** (1901): 165–197.
Pearl Oysters and Pearl Fisheries. By O. Collett.
Remarks upon some of the questions referred to in Mr. Collett's paper on "Pearl Oysters and Pearl Fisheries," by Captain J. Donnan.

Commercial Geography—Tea. **McEwan.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 449–456.
The Geographical Distribution of the Tea Plant in Growth and of its product in consumption. By John McEwan. *With Map.*

Economic Geography. **Rehbock.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 545–554.
Der wirthschaftliche Werth der Subtropen in seiner Abhängigkeit von der Wasserfrage. Von Prof. Th. Rehbock.

Ethnology. *Verh. Ges. Erdk. Berlin* **28** (1901): 356–359. **Boas.**
Die Jesup-Nordpacifische Expedition. Von Prof. Dr. Franz Boas.

Ethnology. *Verh. Siebenten Internat. G. Kongresses*, 1899, **2** (1901): 678-685. **Boas.**
The Jesup North Pacific Expedition. By Prof. Dr. Franz Boas.

Ethnology. *Verh. Siebenten Internat. G. Kongresses*, 1899, **2** (1901): 586-597. **Wilser.**
Rassen und Völker. Von Dr. Ludwig Wilser.

Ethnology—Aryans. **Ratzel.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 575-585.
Der Ursprung der Arier in geographischem Licht. Von Prof. Dr. Friedrich Ratzel.

Historical—Christianity. *Sitzb. A.W. Berlin* (1901): 810-845. **Harnack.**
Vorstudie zu einer Geschichte der Verbreitung des Christenthums in den ersten drei Jahrhunderten. Von Adolf Harnack.

Historical—Early Globe. **Estreicher.**
Tad. Estreicher. Globus Biblioteki Jagiellońskiej z początku w. XVI. (Ein Erdglobus aus dem Anfange des XVI. Jh. in der Jagellonischen Bibliothek). Vorgelegt den 15 Januar 1900. (Bulletin International de l'Academie des Sciences de Cracovie Mars 1900.) Size 9 × 6, pp. 96-105. [Also version in Polish, pp. 18.] *Illustration. Presented by the Author.*

See note in *Journal* for August, 1901 (vol. xviii. p. 220).

Historical—Ophir. **Keane.**
The Gold of Ophir, Whence brought and by Whom? By Professor A. H. Keane, London: Edward Stanford, 1901. Size 8½ × 5½, pp. xviii. and 244. *Price 5s. net. Presented by the Publisher.*

A review of this appears in the present number (p. 361).

Historical—Sea-mile. **Wagner.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 877-883.
Die Realität der Existenz der Kleinen Mittelmeer-Meile auf den italienischen Seekarten des Mittelalters. Von Prof. Dr. Hermann Wagner.

History of Geography. **Günther.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 819-844.
Der Humanismus in seinem Einfluss auf die Entwickelung der Erdkunde. Von Prof. Dr. Siegmund Günther.

Industries—Distribution. **Halle.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 516-528.
Die Vertheilung der Industrie auf die klimatischen Zonen. Von Prof. Dr. von Halle.

Political Geography. *Rev. G.* **49** (1901): 501-514. **Deschamps.**
La France et l'Angleterre devant l'Islam. Par Léon Deschamps. *With Map.*

Population Maps. **Hettner.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 502-510.
Ueber bevölkerungsstatistische Grundkarten. Von Prof. Dr. Alfred Hettner. *Plate.*

BIOGRAPHY.

Chaix. *Mem. S.G. Genève* **40** (1901): 73-84, 111-119. **Chaix.**
Notice sur les Travaux de Paul Chaix. Par Émile Chaix. *With Portrait.* Catalogue des principales publications de Paul Chaix. Par Émile Chaix.

D'Albertis. *Riv. G. Italiana* **8** (1901): 628-632. **Mochi.**
Di Luigi Maria D'Albertis e della sua opera scientifica. Cenni del Dott. Aldobrandino Mochi.

Kingsley. *J. African S.* (1901): 1-16. **Green.**
Mary Kingsley. By Mrs. J. R. Green.

Nordenskiöld. *Nature* **64** (1901): 450-452. **Bruce.**
Prof. Baron Adolf Erik von Nordenskjöld. By W. S. Bruce.

Nordenskiöld. *Deutsche G. Blätter* **24** (1901): 80-95. **Lindeman.**
Adolf Erik von Nordenskiöld. Von Moritz Lindeman. *Also separate copy, presented by the Author.*

GENERAL.

Geography. — **Redway.**

The New Basis of Geography. A Manual for the Preparation of the Teacher. By Jacques W. Redway. New York: the Macmillan Co.; London: Macmillan & Co., 1901. Size 8 × 5½, pp. xiv. and 230.

This is reviewed elsewhere (*ante*, p. 368).

Geography and History. — **Kretschmer.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 923–930.

Die Beziehungen zwischen Geographie und Geschichte. Von Dr. Konrad Kretschmer.

Malaria. *C. R l.* **133** (1901): 457–459. — **Billet.**

Sur l'apparition simultanée des moustiques du genre *Anopheles* et des premiers cas de paludisme dans la région de Constantine. Note de M. A. Billet.

Metric System. — **Mill.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 120–124.

On the Adoption of the Metric System of Units in all Scientific Geographical Work. By Dr. Hugh Robert Mill.

Palestine and Egypt. — ———

Guide to Palestine and Egypt. London: Macmillan & Co., 1901. Size 7 × 4½, pp. xx. and 270. *Maps and Plans. Presented by the Publishers.*

This is noticed in the present number with other guides of the same series (p. 366).

Yellow Fever. *Rev. Scientifique* **16** (1901): 686–690. — ———

La fièvre jaune et les moustiques.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. — **Ordnance Survey.**

ORDNANCE SURVEY OF ENGLAND AND WALES:—Revised sheets published by the Director-General of the Ordnance Survey, Southampton, from January 1 to 31, 1902.

6-inch—County Maps:—

Bedfordshire, 1 S.E., 3 S.E., 4 N.E., S.W., S.E., 7 N.W., S.W., 12 N.W., N.E., S.W., S.E., 13 S.W., 15 N.E., S.E., 16 N.W., S.E., 17 N.E., S.E., 18 N.W., S.E., 20 N.E., S.E., 21 S.W., 22 N.W., N.E., S.W., 25 N.W., S.W., 28 S.E., 29 N.E., S.W., 31 (N.E., S.E.), 32 S.W. **Cardiganshire,** 1 N.W., N.E. **Huntingdonshire** (Det.), 13 S.W. **Merionethshire,** 17 N.W., 24 N.W., S.W., 37 N.E., 38 S.E., 39 S.W., 47 S.W., 48 N.W., N.E. **Monmouthshire,** 18 N.W., S.W., 23 S.W., 28 S.W. **Montgomeryshire,** 2 S.W., 12A S.E., 12 S.W., 25 S.W. **Staffordshire,** 36 N.W., 37 N.E. **Wiltshire,** 55 S.E., 72 S.W. (74 N.W., and 74A N.E.) 1*s. each.*

25-inch—County Maps:—

Cambridgeshire, III. 13; V. 4; VI. 1, 5, 6, 7, 8, 11, 12, 16; IX. 16; XI. 4, 8; XII. 1, 2, 5, 6, 9, 13; XV. 4; XVI. 2, 3, 5, 6, 7, 9, 10, 13; XX. 4, 8, 12; XXI. 1; XXXIII. 1; XLIV. 11; XLV. 6. **Dorsetshire,** III. 11, 12, 15; VII. 3, 4, 7, 12, 15, 16; XIII. 3, 7, 8, 11, 12, 16; XXIII. 2, 3, 4, 6; XXXV. 16; XLIV. 1; LVII. 13. **Gloucestershire,** I. 16; III. 8, 10, 11, 12, 15, 16; IV. 1, 2, 3, 9, 10, 13; VI. 7; VII. 2, 5, 6; VIII. 6. **Huntingdonshire,** II. 16; XIX. 14; XXIII. 1; XXVII. 11; XXVIII. 6. **Monmouthshire,** XV. 1, 2, 5, 13; XXI. (1 and 2), 5; XXVI. 9; XXXI. 13; XXXIII. 4. **Montgomeryshire,** XVI. 1, 3, 4, 5, 6, 7, 8, 9, 11; XVII. 1; XXI. 8; XXII. 5; XXXIII. 1, 5, 6; XXXIV. 4. **Shropshire,** III. 16; IV. (9 and 5), 13; IX. 4, 8, 11, 14, 15; X. 1, 5; XV. 7, 8, 12, 16; XVI. 1 (2 and 3), 6, 8, 10, 11, 12, 16; XVII. 5, 9, 13; XXI. 16; XXII. 4, 6, 8, 9; (XXIII. 4 and XXIV. 1); XXIII. 9, 10, 13, 14, 15; (XXIV. 1 and XXIII. 4); XXVII. 13, 14, 15; XXVIII. 8; XXIX. 4, 7, 8, 9, 11, 14, 15, 16; XXX. 1, 2, 4, 5, 6, 7, 9, 10; XXXII. 4, 7, 8, 11, 12; XXXIII. 1, 2, 3, 6. **Staffordshire,** XLV. 1; XLVI. 3, 12, 15, 16; LIII. 13; LIV. 14. **Warwickshire and Do.** (Det.); I. 14; L. 1, 2, 3, 10, 12; LIII. 6. **Worcestershire and Do.** (Det. No. 3); XLIII. 10 (areas of Church Honeybourne Parish only), 11, 15, 16; XLIV. 2, 3, 4, 8, 12; XLV. 13; L. 5 (areas of Broadway Parish only); LII. 1, 5, 9. 3*s. each.* (*E. Stanford, London Agent.*)

England and Wales. **Geological Survey.**

MEMOIRS:—Berkshire, Water Supply of, 3s.

(*E. Stanford, London Agent.*)

Europe. **Barrère.**

Europe. Scale 1 : 4,500,000 or 71 stat. miles to an inch. Paris: H. Barrère, 1901. 2 *sheets*.

A coloured general map showing political divisions, steamer routes and railways. The latter, however, are not altogether accurate; for instance, a line is shown as opened from Bergen to Christiania, while, as a matter of fact, this line runs no further than Vossevangen at the present time.

Europe. **International Geological Commission.**

Carte géologique internationale de l'Europe. Scale 1 : 1,500,000 or 23·7 stat. miles to an inch. Livraison iv. Berlin: Dietrich Reimer, 1902. *Presented through the Director of the Geological Survey, London.*

This is the fourth issue of the Geological map of Europe proposed by the International Geological Congress at Bologna in 1881, and executed conformably with the decision of an International Commission with the approval of the various governments, under the direction of MM. Beyrich, Hanchecorne, and Beyschlag. It is printed in carefully selected colours showing the various formations, and when complete will consist of forty-nine sheets, of which twenty-five have already appeared. The present part contains the following sheets: 3 (C I.) (almost a blank), eastern part of Jan Mayen island; 10 (C II.), Western Norway from the Lofoten islands to Aalesund; 17 (C III.), Southern Norway and Sweden; 11 (D II.), North part of the Gulf of Bothnia and surrounding portions of Finland and Sweden and Norway; 18 (D III.), Parts of Russia and Sweden around the northern Baltic and Gulf of Finland; 19 (E III.), St. Petersburg, Moscow, and neighbourhood; 26 (E IV.), Smolensk, Kursk, and the valley of the Dnieper.

Germany. **Konigl. Preuss. Landes-Aufnahme.**

Karte des Deutschen Reiches. Scale 1 : 100,000 or 1·6 stat. miles to an inch. Sheets: 173, Aurich; 176, Bremervörde; 177, Buxtehude; 207, Ottersberg; 260, Nienburg. Herausgegeben von der Kartogr. Abtheilung der Konigl. Preuss. Landes-Aufnahme, 1901. *Price* 1.5*m each sheet.*

Historical Atlas. **Poole.**

Historical Atlas of Modern Europe, from the Decline of the Roman Empire; comprising also maps of parts of Asia and of the New World connected with European History. Edited by Reginald Lane Poole, M.A., PH.D., Fellow of Magdalen College, and Lecturer in Diplomatic in the University of Oxford. Part xxviii. Oxford: The Clarendon Press; London Edinburgh, Glasgow, and New York: Henry Frowde, M.A.; Edinburgh: W. & A. K. Johnston. 1901. *Price* 3*s*. 6*d*. *Presented by the Clarendon Press.*

After an interval of about eighteen months, another part of this instructive atlas has appeared. There are yet two parts to be published to complete the work, and it is to be hoped that it may not again be found necessary to allow so long a time to elapse between the dates of issue. This part contains the following maps: No. 42, illustrating the growth of Prussia, 1415 to 1890. No. 66, Italy, c. 1167 to 1250. No. 83, India under Mohammedan Rule: The Kingdom of Delhi, A.D. c. 1340; The Moghul Empire at the death of Akbar, A.D. 1605. Mr. C. Grant Robertson, M.A., writes the letterpress for the map of Prussia, Miss Lina Eckenstein for that of Italy, and Prof. Lane Poole describes India under Mohammedan Rule.

Iceland. **Thoroddsen.**

Geological Map of Iceland. By Th. Thoroddsen. Surveyed in the years 1881 to 1898. Scale 1 : 600,000 or 9·5 stat. miles to an inch. Edited by the Carlsberg Fund, 1901. Copenhagen: A. E. Aamodt. 2 *sheets*.

This map shows the results of Th. Thoroddsen's geological investigations in Iceland, made during his extensive travels and surveys in the island from 1881 to 1898. Several maps, by the same author, have been previously published, showing the geology of different districts, but now these have been brought together, and the information shown upon one general map of the island.

ASIA.

Asia Minor. **Kiepert.**

Karte von Kleinasien. Scale 1 : 400,000 or 6·3 stat. miles to an inch. Von Dr.

Richard Kiepert. Sheets: A IV. Sinob; C III. Konia. Berlin: Dietrich Reimer (Ernst Vohsen), 1902. *Price 6 marks each sheet.*

Two additional sheets of Dr. R. Kiepert's new map of Asia Minor, which was noticed in the *Geographical Journal* for last month. Four other sheets, "Ermenek," "Karsarie," "Unie," and "Adana," are now in the hands of the lithographer, and will doubtless be published before long.

Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas, 4 miles to an inch. Sheets: 65, parts of districts Almora, Garhwál, Native State of Tehri Garhwál (North-Western Provinces), of district Kangra, Native States of Bashahr and Kanawar (Punjab), and of Hundes or Narikhorsuna and Monyal (Tibet), 1901; 42 S.E., parts of districts Shimoga, Kadur, and Chitaldrug (Mysore) and Dharwar (Bombay), 1899; 48 N.E., parts of districts Dehra Dun, Saharanpur, Garhwál, and Native State of Tehri Garhwál (North-Western Provinces), and districts Umballa, Karwál, and Native States of Sirmur, Pátiála and Kálsia (Punjab), 1900; 48 N.W., parts of districts Umballa, Ludhiana, and Karnál, and of Patiála, Nabha, Jind, Maler Kotla, and Kalsia, Native States (Punjab), 1897; 48 S.W., parts of districts Hissar and Karnál, and Native States of Patiála and Jind (Punjab), 1899; 48 S.E., parts of districts Dehra Dun, British Garhwál, Saharanpur, Muzaffarnagar, and Bijnor (North-Western Provinces), and Karnal and Umballa (Punjab), 1900; 52 N.W., parts of Native States Gwalior and Indore (Central India Agency), Udaipur, Tonk, Jhalawar, and Kotah (Rájputána Agency), 1899; 59 N.W., parts of districts Shimoga and Chitaldrug (Mysore State), Bellary, and Anantapur (Madras Presidency), and Dhárwár (Bombay Presidency), 1901; 71 N.W., parts of districts Narsinghpur, Saugor, Damoh, Hoshangabad (Central Provinces), and of Native States Bhopal Gwalior, Nawab Basoda, and Muhammadgarh (C. I. Agency), 1899; 71 S.W., parts of districts Narsinghpur Hoshangabad, Betúl, Chindwára, and Seoni (Central Provinces), and Native State of Bhopal (C. I. Agency), 1899; 72 S.W., parts of districts Nágpur, and Wardha (Central Provinces), and Amráoti of Berar (Hyderabad Assigned Districts), 1899; 78 N.W., parts of districts North Arcot, Cuddapah (Madras Presidency), and of Kolar (Mysore), 1901.—Lower Provinces Revenue Survey, 1 mile to an inch. Sheets: 4, 5, District Purneah, additions to boundaries, 1897. 1901.—Assam Survey, 1 mile to an inch. Preliminary edition. Sheets: 16, Districts Kámrup and Goálpára, Seasons 1893–95 and 1896–97, 1901. 28, district Kámrup, Season 1885–86, 1901. 69, District Cachar, Season 1880–33. 1901.—Central India and Rájputána Survey, 1 mile to an inch. Sheets: 206, parts of Gwalior, Indore, Tonk, and Jaora (C.I. Agency), and of Udaipur and Partábgarh (Rájputána Agency), Season 1875–76, 1901. 227, parts of Native States Jaipur, and Jodhpur (Rájputána Agency), Season 1866–67, 1900. 229, parts of District Ajmer, and of Native States Jaipur, and Kishangarh (Rájputána Agency), Season 1868–69, 1901. 247, parts of Native States of Holkar, Dhár, Gwalior, and Barwáni (C.I. Agency), Season 1872–74, 1899. 320, parts of Gwalior (C.I. Agency), and Jaipur and Karauli (Rájputána Agency), Season 1864–66, 1901. 324, parts of Native States Gwalior (C.I. Agency), and of Kotah and Jhallawar (Rájputána Agency), Season 1870–71, 1899. 331, parts of Bhopal, Gwalior, Indore, and Dewas (C.I. Agency), Season 1877–78, 1899. 343, parts of Gwalior (C.I. Agency), and of Kerowli and Dholpur (Rájputána Agency), Season 1863–65, 1901. 347, parts of Native States Gwalior (C.I. Agency), and Jhalawar (Rájputána Agency), Season 1864–66, 1901. 365, part of Gwalior (C.I. Agency), Season 1863–64, 1900.—North-Western Provinces and Oudh Survey, 1 mile to an inch. Sheets: 14, district Saharanpur. Season 1878–80, 1900.—205, district Gorakhpur, Season 1885–88, 1901.—South-Eastern Frontier, 1 mile to an inch. Sheets: 1 N.W. (4th edit.), parts of districts North and South Lushai Hills, and Native State of Manipur (Assam), Hill Tippera (Bengal), and Chin Hills (Upper Burma), Seasons 1853–66, 1871-72, 1888–94, 1900. 4 N.W. (6th edit.), parts of districts Katha, Bhamo, Shwebo, Ruby Mines, and Northern Shan States (Upper Burma), Seasons 1886–95, 1901.—Berar or the Hyderabad Assigned Districts, 1885, 8 miles to an inch. Additions to 1900.—Calcutta and surrounding country (3rd edit.), 1 mile to an inch. 1900. 3 sheets.—Map of the country 10 miles around Calcutta (Fort William), 1 mile to an inch. 1901.—Mysore, 10 miles to an inch. 1900 (with an index).—Central Provinces, 80 miles to an inch. 1901.—District Mandla, Central Provinces, 8 miles to an inch. 1899. —Conventional signs to be used on topographical maps. 2 sheets.—*Presented by H.M. Secretary of State for India, through the Indian Office.*

Indo-China. **Lunet de Lajonquière.**

Atlas Archéologique de l'Indo-Chine. Monuments du Champa et du Cambodge par le Capitaine E. Lunet de Lajonquière. Scale 1 : 500,000 or 7·8 stat. miles to

an inch. Publications de l'École Française d'Extrême-Orient. Paris: E. Leroux, 1901. *Presented by l'École Française d'Extrême-Orient.*

Throughout Indo-China there are to be found numerous evidences of an ancient Hindu civilization in the form of ruins of temples, palaces, statues, and inscriptions; and although the existence of some of these has been known for years past, yet it is only recently, since the French have undertaken a survey of the country, that many others have been brought to light. This atlas shows the position and special character of a great number of these antiquities, and, so far as the area it includes is concerned, it appears to be very complete. It consists of four maps arranged in the following order: South Annam, North Annam, South Cambodia and North Cambodia, in addition to which there is a general map of the whole of Indo-China as an index, and upon which are also given the position of the principal temples, &c., lying outside the limits of the larger-scale maps. The sheets of the 'Carte de l'Indo-Chine,' on the scale of 1 : 500,000, now in course of publication by the Bureau Topographique des Troupes de l'Indo-Chine, serve as a basis for the atlas. Upon these the archæological information, including also the sites of old bridges, roads, etc., is shown in red. In some instances corrections and additions have been made to the topography of the country as previously shown on the maps. The atlas also contains tables giving the names and situations of the antiquities and points of archæological interest which are laid down upon the maps. The portion of Cambodia here dealt with is only that occupied by the French; later on it is intended to publish a supplement to the present work, giving similar information concerning Siamese Cambodia.

AFRICA.

Sahara. **Mission Coppolani.**

Carte de la Mauritanie Saharienne. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. D'après les documents relevés sur place et les renseignements de source indigène recueilles par la mission Cappolani chez les Maures et les Touareg, et les itineraires connus. Paris: A. Challamel, 1902. 4 sheets.

This large four-sheet map shows the whole of the Sahara, from the Wadi Draa on the north to the Niger below Timbuktu on the south, and from the Atlantic coast on the west to the meridian of Paris on the east. As M. Coppolani's mission travelled only in the region of the Senegal and Niger, with the exception of a journey into the Sahara to the north of Timbuktu as far as Arawan (in about lat. 19° 10′ N.), it is evident that by far the greater part of this map is compiled from the work of other explorers and native reports. Many areas are still unexplored, but the map contains a great deal of information, of a more or less reliable character, as well as the routes of several other travellers. It is clearly printed in colours. An inset plan of Arawan and neighbourhood is given.

West Africa. **Bourdariat.**

Carte de la Côte d'Ivoire. Scale 1 : 600,000 or 9·5 stat. miles to an inch. Par A. J. Bourdariat. Paris: H. Barrère.

Compiled from the author's own surveys and observations as well as from those of other travellers, including the maps of Binger, Marchand, Pobéguin, and Spicq. It is to a great extent a mining map, and shows the limits of the region open to the exploitation of mines, the areas concerning which *permis de recherches* were sought and granted between January 1 and November 15, 1901, as well as a list of persons and companies holding concessions, and other information of a kindred character. Travellers' routes and proposed railways are also shown.

AMERICA.

Argentine Republic. **Argentine Boundary Commission.**

Sixteen Maps of the Cordillera de los Andes. From the surveys of the Argentine Boundary Commission. (1) N.W. Region of the Argentine Republic, 1 : 1,000,000; (2) Region between 38° 50′ and 41° 10′ S. lat., showing the proposed Argentine and Chilian boundary-lines, 1 : 500,000; (3) Ipela ridge and lakes Huechu-Lafquen, Lolog and Lacar, between 39° 40′ and 40° 30′, 1 : 100,000; (4) Region between 41° 0′ and 43° 40′ S. lat., showing the proposed Argentine and Chilian boundary-lines, 1 : 500,000; (5) Region between 43° 0′ and 45° 20′ S. lat., showing the proposed Argentine and Chilian boundary-lines, 1 : 500,000; (6) Showing the Continental divide in the Tertiary tableland between 43° 30′ and 44° 45′ S. lat., 1 : 100,000; (7) Region between 45° 0′ and 47° 20′ S. lat., showing the proposed Argentine and Chilian boundary-lines, 1 : 500,000; (8) Headwaters of rivers Aisen and Mayo, between 45° 14′ and 46° 10′, 1 : 200,000; (9) Valley of lake Buenos Aires and rivers Fenix and Deseado, 1 : 100,000; (10) Region between 47° and

49° 30′ S. lat., showing the proposed Argentine and Chilian boundary-lines, 1 : 500,000; (11) Region between 49° 30′ and 52° 30′ S. lat., showing the proposed Argentine and Chilian boundary-lines, 1 : 500,000; (12) Orographical preliminary map of the S.W. Region of the Argentine Republic, 1 : 1,000,000; (13) Preliminary map of the S.W. Region of the Argentine Republic, 1 : 1,000,000; (14) Preliminary map of the S. Region of the Argentine Republic, 1 : 1,000,000; (15) Region between 50° 40′ and 52°, showing proposed Chilian boundary-line, 1 : 200,000; (16) Region between 50° 40′ and 52°, showing proposed Argentine boundary-line, 1 : 200,000. *Presented by the Argentine Boundary Commission, through Dr. F. P. Moreno.*

Whatever may be the political results of the dispute between the Argentine Republic and Chile concerning their boundary in the Andes, it is certain that the cause of geography will profit considerably by it. As has often been the case under similar circumstances, very little was known of most of the disputed districts until this difficulty arose, and it became necessary to despatch properly organized expeditions to survey and map them. An inspection of the sixteen maps in this portfolio will show how much has already been accomplished by the surveyors of the Argentine Boundary Commission on the eastern slopes of the Andes, while quite recently much fresh information has been obtained which will be published later on. The Chilians have, for a long time past, also been engaged in survey work, so before long we may hope to possess a fairly perfect map of the central and southern Andes.

New York. **Stevens.**

B. F. Stevens's Facsimile of the Unpublished British Head Quarters Coloured Manuscript Map of New York and Environs (1782). Reproduced from the original drawing in the War Office, London. Scale about 6½ inches to a mile. Issued only to subscribers at 4, Trafalgar Square, London, 1900. 24 sheets. *Price* £5 5*s.*; or mounted and folded in case, £6 6*s.*

The original plan, of which this is a facsimile, was made from surveys by Engineer officers during the British occupation of New York from 1776 to 1783. It is drawn on the scale of about 6½ inches to a mile, and extends from just below Guanas bay to the heights of Spikendevil, and thus includes the whole of New York island and a great part of Brooklyn, as well as a portion of the New Jersey shore in the neighbourhood of Paulus Hook. When the British evacuated New York this plan was brought to London and deposited at the War Office, where it has been ever since. Mr. Stevens has now published a limited number of facsimiles, in twenty-four sheets, which will be of great service to historians and all those interested in the study of this important period of American history. The plan is coloured, and shows the then existing fortifications, defences, buildings, streets, roads, on New York island, as well as river frontages and military works on Long Island, Paulus Hook, and the shores of New Jersey. There is a complete explanatory table and an index plan.

AUSTRALASIA.

New Zealand. **Department of Lands and Survey, Wellington.**

Map of New Zealand. Scale 1 : 982,080 or 15·5 stat. miles to an inch. Wellington: Department of Lands and Survey, 1901. 2 sheets.

Boundaries of countries, with their names, are shown in red. There is no hill-work, but altitudes are given in figures. Railways and roads are shown.

GENERAL.

World. **Schrader.**

L'Année Cartographique. Supplément annuel à toutes les publications de Géographie et de Cartographie. Dressé et rédigé sous la direction de F. Schrader. Onzieme supplément. Contenant les modifications Géographiques et Politiques, des Années 1899–1900. Paris: Librairie Hachette et Cie., 1902. *Price* 3 *francs.*

For the past eleven years this little publication has been issued under the direction of M. F. Schrader, and although the maps are on small scales, and the accompanying letterpress is necessarily very brief, it has proved decidedly useful as a summary of the principal geographical events for general reference. The present issue, showing the geographical progress during 1899–1900, contains three sheets of maps, the first of which is devoted to Asia, the second to Africa, and the third to America. The sheet for Asia gives the results of Captain H. H. P. Deasy's surveys in Central Asia; a map of French Indo-China showing administrative divisions, another of Southern Annam, and a small inset of the French territory of Kwang-chau. There are eight

small maps on the African sheet, the principal of which show recent explorations and explorers' routes in French Congo, Southern Abyssinia, and the upper Zambezi. The map of Southern Abyssinia, however, does not give the work of Mr. J. J. Harrison's expedition, nor his route. The other maps on this sheet consist of French West Africa showing administrative divisions, the Ivory Coast, the lake region from Tanganyika to Albert Nyanza and Northern Rodesia, and the Anglo-German frontier between Nyasa and Tanganyika. On the sheet for America there are maps showing the regions in dispute between Chili and Argentina, from the surveys of the Argentine Boundary Commission, the explorations of Captain H. Bolland along the Rio Bermejo-Teuco; the Rio Uaupès, from a complete survey by Count E. Stradelli; Mr. D. Hanbury's explorations in the neighbourhood of Chesterfield inlet, and a map of Southern Brazil showing the railways. Descriptive letterpress is as usual given upon the back of each sheet.

World. **Smith.**

Foreign Mission Atlas. Edited by Dr. George Smith, C.I.E. Edinburgh: Foreign Mission Office, 1902. *Presented by the Foreign Mission Office.*

A useful little reference atlas for those interested in the work of foreign Christian missions. The maps, which are twelve in number, are by Bartholomew, and show the names of the mission stations of the United Free Church of Scotland underlined in red. There is also a list of the mission stations, with the date of their foundation.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during November and December, 1901. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
3207 m	= 6·8	Northern entrance to Achill sound, including the approaches to Tonregee. 2*s*. 6*d*.
3215 m	= 1·5	France, west coast:—Goulet de Fromantine to Pointe de St. Gildas. 2*s*. 6*d*.
3166 m	= 3·0	West Indies:—Puerto Rico island, Jobos harbour. 1*s*. 6*d*.
3188 m	= 1·8	Central America:—Gulf of Mexico, Sabine pass. 1*s*. 6*d*.
1284 m	= 0·07	South America, east coast:—Cape Dos Bahias to Staten island. 2*s*. 6*d*.
3226 m	= 1·4	South America, east coast:—Port Santa Cruz. 2*s*. 6*d*.
616 m	= $\left\{\begin{matrix}1\cdot0\\8\cdot0\end{matrix}\right\}$	Africa, west coast:—Sierra Leone river and anchorage. 2*s*. 6*d*.
3211 m	= 5·9	Africa, east coast:—Zanzibar island. Zanzibar harbour. 2*s*. 6*d*.
1988 m	= 0·72	China, east coast:—Approach to Samsa inlet. 2*s*. 6*d*.
3184 m	= 5·9	China, Plans in the Yang Tse Kiang:—Itu reach. 1*s*. 6*d*.
3216 m	= $\left\{\begin{matrix}9\cdot0\\7\cdot5\\9\cdot0\end{matrix}\right\}$	Japan:—Plans on the east coast of Nipon island: Nakanosaku. Hakuchi, Naka Minato, Hirakata wan. 1*s*. 6*d*.
3186 m	= 0·5	Australia, north-west coast:—Mary Ann passage and approaches. 2*s*. 6*d*.
3187 m	= 0·5	Australia, west coast:—Mangrove islands to North-west cape. 2*s*. 6*d*.
3221 m	= 2·95	Plans on the south coast of Australia:—Duke of Orleans bay, Goose island bay. 1*s*. 6*d*.
2662		Celebes:—Ports in Makassar strait. Plans added:—Lingadang road and Belonlioh bay, Pambauwang road, Chinrana and Binanga bays.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.		Cancelled by	No.
954	Achill sound, northern entrance.	New plan. Northern entrance to Achill sound	3207
1639	Sabine pass, plan on this chart.	New chart. Sabine pass	3188
1284	Cape Three points to the strait of Magellan.	New chart. Cape Dos Bahias to Staten island	1284
1292	Plan of Port Santa Cruz, on this sheet.	New plan. Port Santa Cruz	3226
538	Anchorages on east coast of Vancouver island.	New plans of same anchorages	538

No.		Cancelled by	No.
616 Plan of Sierra Leone river.		New chart. Sierra Leone river	616
2196 Wowoni strait, etc. Plan on this sheet.		New plan of same on same sheet	2196
2662 Plan of Cape Rivers and Chinrana bay on this sheet.		New plans. Lingadang road and Belonlioh bay, Chinrana and Binanga bays	2662
1988 Sam sa bay and inlet.		New chart. Approach to Sam sa inlet	1988

Charts that have received Important Corrections.

No. 1991, England, south coast:—Folkestone harbour 1951, England, west coast:—Liverpool bay 1975, England, east coast:—River Thames: Kentish Knock to the West Swin. 2693, England, east coast:—Orwell and Stour rivers. 2845, England, Channel islands:—Alderney harbour. 1297, Norway:—Lepsö to Ona. 1298, Norway:—Approaches to Molde. 1972, Norway:—Approaches to Trondhjem, eastern sheet. 1343, France, west coast:—Adour river from the entrance to Bayonne. 1422, North America:—Labrador. 327, Lake Huron:—Georgian bay. 2908, Africa, south coast:—Port Natal entrance. 1005, Africa, east coast:—Pungue river, Beira harbour. 759A, Madagascar:—Cape St. Andrew to Bevato island. 143, Red sea:—Jebel Teïr to Perim island. 2413, Malacca strait:—Rhio strait. 1789. Malacca strait:—Channels between Sumatra and Linga. 941B, Eastern archipelago:—Western portion. 942A, Eastern archipelago:—Eastern portion. 3044. Celebes:—Ujong Jonga to Ujong Kassi. 2636, Philippine islands:—Strait of Makasser. north part. 2391, Philippine islands:—Port Ilo Ilo. 975. Philippine islands:—Port Kavite. 2660B, China sea:—Southern portion. 2357, China, north coast: Ching Wang Tao road. 1708, Australia, sheet II:—Albert river. 917, Australia, west coast:—Harbours and anchorages on the west coast. 1700, Australia, west coast: –Fremantle harbour and Gage roads. 1059. Australia, south coast:—Doubtful island bay to the head of the Great Australian bight. 2984, Australia, south coast:—Esperance bay.
(J. D. Potter, Agent.)

North Atlantic Ocean and Mediterranean Sea. **Meteorological Office, London.**

Pilot Chart of the North Atlantic and Mediterranean for February. 1902. London: Meteorological Office. *Price 6d. Presented by the Meteorological Office, London.*

Russian Charts. **Chief Hydrographic Department, Ministry of Marine, St. Petersburg.**

Baltic.

No.
1825 Southern part of the Baltic from Rugen to Warnemünde. Scale 1 : 100,000 or 1·6 stat. mile to an inch. 1901.
1826 Southern part of the Baltic from Warnemünde to Femern island. Scale 1 : 100,000 or 1·6 stat. miles to an inch. 1898.
566 Plan of Windu. Scale 420 feet to an inch. 1900.

North Pacific.

1829 Plan of Vostok bay. Scale 1400 feet to an inch. 1899.
577 Index to charts on the North Pacific coast from Posiette bay to America bay. 1901.

United States Charts. **United States Hydrographic Office.**

Pilot Charts of the North Atlantic for January, and North Pacific for February. 1902. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

The

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THE VOYAGE SOUTHWARD OF THE "DISCOVERY."*

I. LONDON TO MADEIRA.

By HUGH ROBERT MILL, D.Sc., LL.D., Sec. R. Met. Soc.

I have been privileged to take only a small part in the preparations for the *Discovery* expedition, and the report of my work requires few words, even if a brief account of the voyage as far as Madeira is included.

On July 27, 1901, I was asked by Captain Scott and Mr. George Murray to accompany the *Discovery* on the first short stage of her voyage, in order to instruct the observers on board in the methods of oceanographical work. From having been a member of the meteorology sub-committee, I was already aware of the plans so far as the investigation of atmospheric conditions was concerned. After acquainting myself with the apparatus and material which had been provided for the study of the sea, I joined the *Discovery* in Stokes bay on August 3, she having left the Thames on July 31.

The time before sailing was fully occupied in the completion and adjustment of some of the apparatus, and seeing to the stowing of all the instruments and chemicals in the physical laboratory, so that they should not be endangered by the rolling of the ship.

On August 5 the *Discovery* moved across the Solent and anchored off Cowes. Sir Clements Markham, Mr. Longstaff, Sir Leopold McClintock, Sir Allen Young, Admiral A. H. Markham, and Mrs. Scott were on board, and at 11.30 a.m. their Majesties the King and Queen and H.R.H. Princess Victoria paid a private visit of inspection. The genuine interest

* Papers read at the Royal Geographical Society, February 24, 1902.

which the royal party took in the ship and in every department of the scientific work was most gratifying and stimulating to every one on board. They not only visited every part of the vessel, but inquired the use of each piece of apparatus shown to them, and watched its working with the keenest attention. The Queen was particularly attracted by Forel's xanthometer (an instrument for measuring the colour of the sea by comparison with a graduated series of solutions ranging from pure blue to yellowish-green), and, after seeing how it was used, herself explained the method to the King. The presentation of signed portraits to the wardroom mess, and of the Royal Victorian Order to Captain Scott as a mark of the King's confidence in him, gave

RAIN-GAUGE, PLACED ON THE HYDROGEN CYLINDERS ON THE PORT QUARTER OF THE *DISCOVERY*.

pleasure to all, and the friendly cordiality which characterized the King's brief speech of farewell to the ship's company will be a heartening memory in many a dreary hour of antarctic winter.

On August 6 the *Discovery* weighed anchor at noon, and proceeded down channel under steam in the teeth of half a gale of wind, stopping off Yarmouth, in the Isle of Wight, to land the last of the friends who had accompanied the explorers so far. Eight days were occupied in making the passage to Madeira. The weather was fine, although the sky was rarely altogether free from cloud, and there was only one night on which the sunset was sufficiently clear to show the interesting phenomenon of the green ray. This was on Sunday, August 11, when, as the upper edge of the sun touched the sea-horizon, a beam of yellow light, almost instantaneously passing through green to blue and dying

away in violet, was distinctly visible. It is remarkable that so few observers have noticed this very striking appearance, which must be visible every time the unclouded sun dips beneath a sharp horizon.

The *Discovery* arrived off Funchal, in Madeira, at 2 a.m. on August 15, and, after some slight repairs to the rigging, she started on the evening of the following day. A small tug towed the ship 4 miles out into the full strength of the trade-wind, and at 6.30 p.m. she was cast off, proceeding for the first time under sail unaided by

MAINMAST UNDER FULL SAIL.

steam. Half an hour later, just as the sun was setting on Friday, August 16, I took the last photograph of the departing vessel, and turned back to Madeira with many regrets.

So far as my limited experience went, the *Discovery* proved a particularly comfortable ship, for her rolling was remarkably easy compared with that of most steamers of her size. The officers and scientific staff shook down to their work at once, and the greatest harmony and good humour prevailed in the wardroom, and indeed

throughout the ship. I was never in pleasanter company, nor among men more honestly bent on doing their very best to make the most of the splendid opportunity presented to them. The essentially scientific turn of Captain Scott's mind impressed me strongly, and the rapidity with which he mastered the details of oceanographical and meteorological work was remarkable. His quiet firmness and tact in a difficult and unusually responsible command are equally striking. For the routine observations now most urgently required, I feel sure that the organization of the British Antarctic Expedition is not inferior to that of our German colleagues on the *Gauss*, or our Swedish fellow-workers on the *Antarctic*.

With regard to the work in departments of which I have special knowledge, I ought perhaps to pass over that in meteorology, as I had little to do with it on board. The Meteorological Office had done its work thoroughly in the provision of instruments, and the officers who were to conduct the observations had been fully instructed at Kew Observatory. Still, a few remarks may be of interest.

For the routine observations, a form of Stevenson screen is erected on the wall of the botanical laboratory on the port side, and when the ship is under way there will always be a current of air blowing through the gangway between it and the magnetic house. The screen contains a wet and dry bulb thermometer, a mercurial maximum, and a Sixe's maximum and minimum. The barometer, on the Kew pattern, was in the magnetic house, with its cistern about 12 feet above the water-line (though I believe it was afterwards moved), and a barograph is kept at work in one of the companions. A thermograph and a hair hygrograph are placed on the outer walls of the magnetic house, and the three recording instruments are kept running to Greenwich time, a mark being made on the curve each day at local noon, so that a local time-scale may be afterwards applied. As the ship's time will be changed daily by amounts varying from a few minutes up to perhaps an hour or more, it would of course be impossible to adjust the recording instruments to follow it. The temperature readings are checked by means of an Assmann's Aspiration Psychrometer, and sling thermometers are also provided for comparison. Rainfall observations are made by means of a marine rain-gauge on Dr. Black's pattern, the placing of which was a matter of some difficulty, on account of the way in which any part of the vessel may be sheltered when she is under sail. The method finally adopted was to place the rain-gauge upon the cylinders containing gas for the balloon, on the top of the small deck house aft, on the weather side, shifting it whenever the ship changes her tack. The result will not be a perfect record, but it will be a fair test of the value of a rain-gauge at sea.

The surface temperature of the sea is taken each time the instruments on board are read, a small canvas bucket being used from the

bridge for the purpose of drawing a sample of water. Once daily, at noon, the colour of the sea-water is measured by means of Forel's colour-scale, or xanthometer. As this observation requires a keen colour-sense, it has been placed in charge of Dr. E. Wilson, the artist of the expedition.

The whole of the meteorological work on board is under the special charge of the first officer, Lieut. Charles Royds, R.N., who has had considerable experience in observing.

For reaching great elevations in the air, reliance is to be placed on kites, and for this purpose light aluminium meteorographs have been provided for attachment to the large box-kites of Hargrave's pattern. While in the Bay of Biscay, an experiment was made in flying a couple of small box-kites tandem-fashion from the ship, and they were found

THE *DISCOVERY* LEAVING MADEIRA.

to rise readily and maintain their altitude steadily for nearly an hour when the ship was running before the wind, and therefore in the least favourable condition for the experiment. No instruments were attached, and the only difficulty found was that the kites descended too abruptly.

It was interesting, on the voyage out, to see how, as the ship left the region of the variable westerly winds and entered that of the steady Trades, the barograph traces lost the irregular ups and downs characteristic of British weather, and settled into the uniform semi-diurnal wave of the tropics, each day reproducing the gently rising and falling curve of the day before.

The thermometers supplied for use on shore, or during the wintering, were graduated so as to be capable of showing temperatures lower than any that have yet been recorded in nature. For measuring wind-pressures, Mr. W. H. Dines supplied one of his pressure-tube

anemometers, with a special adjustment fitting it for use in extreme cold. A sunshine-recorder has also been designed which will admit of a continuous record when the sun remains above the horizon during the whole twenty-four hours.

Oceanographical research in the antarctic area is of particular importance, as all the evidence which is at present available points to the Southern ocean as the mainspring of the circulation of all the seas of the globe. It is desirable, therefore, to have observations connecting the temperate and tropical oceans with the Southern. This was attempted on the voyage of the *Discovery* by regular observations of the temperature and salinity of the surface water twice daily. The determinations of salinity on board a small vessel cannot possibly be made with the minute degree of exactness properly insisted on in a laboratory on shore; but they can be made with quite sufficient accuracy for the purpose of elucidating the physical condition and probable movements of the water. Two methods are employed—that of specific-gravity determinations by means of Buchanan's absolute hydrometer, and that of chlorine determinations by the use of a standard solution of silver nitrate. In this way two entirely independent values for the salinity are obtained for each sample. The physical laboratory in which these observations were carried on at first, is possessed of one great advantage for work in polar regions, for its proximity to the galley ensures that it is always warm; but in the tropics this was so little of a benefit that I understand the work was removed to one of the cabins. This laboratory also became inconveniently crowded with iron apparatus of all kinds, as it lies outside the non-magnetic area within which the zoological and botanical laboratories stand, and these are consequently not allowed to contain so much as a file or an iron wire bottle-brush.

Lieut. E. H. Shackleton undertook the salinity determinations, and proved a very apt and enthusiastic pupil. The record of his work from Madeira to Cape Town, which I have seen, bears every mark of care and accuracy. In the absence of a trained chemist, it seemed inexpedient to attempt the collection and analysis of the gases of sea-water, or determinations of alkalinity or ammonia. It may be mentioned that the distilled water required for the various solutions is provided on board, thanks to the care with which Mr. Skelton manages the distilling plant in the engine-room. The chemicals for standard solutions were weighed on shore, and each quantity separately sealed up in a glass tube. Mr. Ferrer, the geologist, had received instruction from Prof. Letts in the use of a special apparatus for determining the amount of carbonic acid in the atmosphere, which he fitted up in the physical laboratory; but the difficulties in the way of carrying out the work are very great. All chemical work at sea has to be performed under difficulties, and is only possible in a very carefully planned laboratory adapted structurally to the special work that is to be

undertaken, so as to ensure sufficient light and secure resting-places for every piece of apparatus, however small.

The appliances for deep-sea work, most of them supplied by the Admiralty, comprised an ample supply of Miller-Casella thermometers, a certain number of Negretti and Zambra's reversing thermometers in Magnaghi frames, and several Challenger-type water-bottles for collecting samples at various depths. Most reliance will, however, be placed on the Pettersson-Nansen insulating water-bottle, which secures a sample of water and enables the exact temperature to be taken simultaneously. Three of these beautiful pieces of apparatus have been supplied, and they are expected to yield most important information as to the distribution of temperature and salinity with depth. I have also sent out a water-bottle on my own pattern for use in shallow water, for which it has certain special advantages.

Convenient cases for holding the thermometer and water-bottles, to be fixed on the after wall of the wardroom companion, were designed on board and made by the ship's carpenter, so that the instruments could be kept safely and conveniently on deck ready for use. Lieut. M. Barne takes charge of the deep-sea apparatus.

The Lucas sounding-machines of large and small size appear to be very well suited for their work; but the steam-gear for working the wire lines had not been fully tested while I was on board.

In this brief sketch reference has only been made to the parts of the work which came under my personal notice, or as to which I gave written instructions to supplement those contained in the 'Antarctic Manual.' I have said nothing as to the captive balloon, the platinum resistance thermometer, the whole magnetic equipment under Lieut. Armitage's charge, the physical apparatus to be used by Mr. Bernacchi, or about many branches of research which will be taken up if time and opportunity permit. And I have said nothing of the arrangements for biological work under the charge of my old friend Dr. Koettlitz and Mr. Hodgson. Over the arrangement of this department Mr. George Murray, the scientific director, personally presided, and I am indebted to him, as to all the officers and to every member of the scientific staff, for much kindness and the most hearty help in all my work on board.

II. FROM MADEIRA TO THE CAPE.

By GEORGE MURRAY, F.R.S.

THE first observation of general interest which I find in my scientific diary after leaving Madeira is under date August 22, obs. lat. 17° 22′ N., long. 20° 7½′ W. It is as follows: "The morning opened with every

visible sign of having been in the vicinity of a gale, and the meteorological observations coincided with these eye observations. . . . At noon there was a remarkable change in the appearance of the water, which I put down without hesitation to the presence of large shoals of diatoms. We started pumping (through tow-nets) at once, and the appearance of the net and the Murray-Blackman funnels confirmed this. So soon as it settled I made a brief examination, finding certainly many Peridinians (*Ceratium* and *Peridinium*), but, far outweighing these, an extraordinary quantity of broken-up organic refuse. Some of it

TRINIDAD ISLAND.

appears to have been digested and excreted by marine crustacea, etc., but most of it looks like decomposed matter from a river, broken-down fragments of vegetation too much decomposed for determination. There are large numbers of bacteria. I inquired our position, and we are about 120 miles off the African coast. The Senegal river is hardly equal to this. I am therefore driven to alternative explanations, viz. an offshore gale, as at present indicated by the meteorological observations, into the effect of which we have run, or an upwelling of inland waters, such as that recorded by Mr. Benest in these parts on the Silvertown Company's ship *Dacia*. The surface temperature is 81°;

the 8 a.m. temperature was 77°·5. Lieut. Shackleton gives the density at 15° 56′ C. = 1·02685, the salinity at 84° F. = 20·75." I commenced that evening a prolonged microscopic examination of this water, finishing at 2 a.m. next day. The result I note as follows: "Most of the organic *detritus* is unrecognizable, but with it now and then there are particles which indicate an origin from land waters. However, this is in small proportion, and it would be dangerous to conclude that this great body of matter had an exclusively land origin. There are more Peridinians in it than I at first thought. It appears that there is commonly here a large patch of greenish-yellowish water, and there is certainly a case for farther investigation, not only of the surface, but of the lower layers by water-bottle." Very soon after 8 a.m. on the next day (lat. 15° 25′ N., long. 20° 25′ W.) we noticed a distinct change in the colour of the sea, and by noon it had regained its normal blue to the casual eye. I append the readings by Dr. Wilson of Forel's xanthometer (adjusted previously by Dr. Mill).*

17 August,	noon	... ...	5	per cent.	yellow
18 "	"	... ...	5	"	"
19 "	"	... ...	7	"	"
20 "	"	... ...	7	"	"
21 "	"	... ...	9	"	"
22 "	8 a.m.	... ...	9	"	"
22 "	noon	... ...	30	"	"
23 "	8 a.m.	... ...	50	"	"
23 "	noon	... ...	9	"	"
24 "	8 a.m.	... ...	5	"	"
25 "	8 a.m.	... ...	5	"	"
26 "	8 a.m.	... ...	5	"	"

Work was now getting reduced to a system, and general directions for all hands, naval and scientific, were drawn up and inscribed in the Order Book by Captain Scott and myself. The most splendid spirit declared itself. While Captain Scott occupied extemporized quarters in the port laboratory, engrossed with his new-found study of the microscope, in which he became miraculously expert almost at once, as did Lieut. Royds, I found myself interested more and more in affairs only verging on my province, and occasionally occupying positions our Commander kindly thought inconsistent with my duty as the parent of a family.

Not only was the general efficiency of the staff in progress, but we began to interest and educate the men in the work of the Expedition, and a weekly course of lectures was begun with lantern slides and microscopic demonstrations to heighten their interest. This

* On my homeward passage in the *Briton*, I found much closer in shore, at the same latitude, precisely similar conditions, and I wish to record these observations in the hope they may be followed up.

immediately had an excellent effect, and I found myself beset with later inquiries as to the meaning of this or that apparatus, or what was the place of some organism in the economy of sea-life, that were as gratifying as they were often puzzling. All this excellent good feeling was kept up without one single break in the "horse latitudes," where one day we collected fifteen tons of rain-water from the deck.

So soon as I observed that our projected course lay near the island of South Trinidad, I entertained the hope that we might be able to effect a landing on so interesting a spot. Its interest to the naturalist lies in the fact that it is an oceanic island of considerable elevation, and some hundreds of miles from the nearest land of any extent, and, but for abortive attempts to settle on it, was uninfluenced by man. Halley (astronomer-royal) landed on it April 17, 1700, and put on it some goats and hogs, and a pair of guinea-fowl from St. Helena. An English attempt to settle on it was made in 1781, and a like unsuccessful settlement was tried by the Brazilians * at a later date. Other recorded landings are by Amaso Delano (1803), Sir James Clark Ross (1839); and doubtless the island has been frequently visited for a few hours at a time by the crews of sailing and other ships. Our sailmaker told us of such landings, and Captain Scott found near our landing-place a record of a visit by H.M.S. *Ruby* in 1889. Most of the above particulars are taken from the 'South American Pilot,' part i. 4th edit. (1893), p. 43, which also records a visit by Captain Buckle in H.M.S. *Growler* in 1844, and from Mr. E. F. Knight's 'Cruise of the *Falcon*.' Mr. Knight spent some time on the island, and gives the only detailed account of it known to me (*loc. cit.*). I have read his 'Cruise of the *Alerte*' since my return.

The island is in lat. 20° 30′ S. long., 29° 22′ W. (approx.), is about 3 miles in length (north-west and south-east), and about 1½ in breadth. It consists of a rugged mass of tumbled volcanic rock, the central peak rising, according to the 'South American Pilot,' to 3000 feet, and according to the Admiralty chart, 2020 feet. The Martin Vaz islets, about 26 miles distant from South Trinidad, are three small barren rocks which have no influence on the fauna and flora of South Trinidad. The picturesque account of Mr. Knight's adventures on the island is easily accessible and well known, and had no small influence on the more adventurous members of our party in whetting their appetite for a "run ashore" on it. The opportunity which it would afford of exercising the observing and collecting powers of our company was the main serious purposes of our landing, though the mere pleasure of the undertaking was shared by all alike, commander, officers, and men. It was easy to tell at a glance at the men who were appointed to land and who were not. One bluejacket is reported to have wept in vexation

* ? Portuguese.

at being left behind. There was a lingering fear, begotten of the navigator's chaff, that we might after all miss this minute oceanic islet in the night, and all hands were comforted by the bright and early intimation at 5 a.m. that land was 20 miles right ahead.

During the next few hours sketchers and photographers were busy, and Dr. Wilson's coloured drawings of the approach to the island render most accurately the dream-like appearance of this remarkable cluster of volcanic peaks in the early tropical dawn. To some of us the out-

COAST OF TRINIDAD ISLAND.

line suggested an early morning view of the old town of Edinburgh, culminating in the Castle Rock; others, perhaps more happily, thought of Arran from the north or north-east. A nearer approach showed our scenery to be wilder and more inhospitable—to be, in fact, the Trinidad of our impressions from Mr. Knight's narrative. But the business in hand began to claim attention.

At 10.30 a.m., according to plan, two whale-boats left the ship. The first, in charge of Captain Scott, contained Dr. Koettlitz, Mr. Hodgson, Mr. Skelton, and myself; the second, in charge of Lieut. Royds,

carried Lieut. Shackleton, Dr. Wilson, and Mr. Ferrar. The proposal was to land near Mr. Knight's cascade, at a rock which he describes as forming a natural pier. To judge by the surf along the coast, it was the only possible landing-place in sight, and, as we approached, it offered few attractions. By anchoring the boats and backing in, all landed without mishap, and our equipment was passed ashore. Two hands were left in each boat with fishing-lines, and I may mention they had excellent sport during our absence, securing forty-four *Balistes* and two small sharks. Forty-three of the *Balistes* were of the same species, and the remaining one was the only specimen of its kind obtained either by the boats or the shore party. The natural pier was not of coral, as Mr. Knight describes it, but of a volcanic rock, which was worn in places in such fashion as to suggest coral to a casual observer.

The shore party were Dr. Wilson, Mr. Hodgson, and Mr. Ferrar, with several hands. Another party, Captain Scott, Dr. Koettlitz, Lieut. Royds, and myself, with four men, ascended the ravine, reaching the tree-fern zone, the lower limit of which was 1090 by both aneroids. Mr. Skelton reached by himself an elevation at another place where he could see, across the island, the Martin Vaz islets on the horizon; and Lieut. Shackleton, also by himself, followed on our track as far as a plateau at the foot of the high waterfall where the stream emerges from the forest of tree-ferns. I shall take each party's story by itself.

Our party found very little of interest at first, the piled-up rocks being partly covered with a coarse *Cyperus*, and here and there in the crevices grew a fern. Another very wiry plant (*Fimbristylis*) appeared higher up, but sparsely, and at about 400 feet another fern. I scraped some fresh-water algæ from stones in the bed of the stream, which was low, though the banks show that at times it must be a deep torrent, here and there branching out into other channels now dry. Two lichens were fairly abundant on the stones and on the trunks of the numerous dead trees, described by Mr. Knight from this and other valleys. These trunks (*Cæsalpinia* sp.) have plainly been dead for many years, and are bleached white, and for a great part covered with lichens. The wood is a hard red wood, and, from the abundance of the trunks, they must represent a considerable forest, now vanished from the island. Dr. Koettlitz was busy all the way up collecting flies, spiders, dragonflies, etc., which were abundant considering the scarcity of vegetation. Mr. Knight appears to have observed no insects. We obtained a few earth-worms here and there, and I should say they were unexpectedly common. At the plateau at the foot of the high waterfall we turned to the right, and, ascending by a precipitous route, reached a ledge, along which we passed to the left to the tree ferns, and stopped in the bed of the stream where it issues from the tree-ferns to fall over the face of the precipice. Some way down the sheer face of this cliff, we observed the basaltic rock take a columnar form, not quite perpendicular, but emerging at an angle from

the rock face. On the way up I collected a sage without flower, which was the only phanerogam, besides the two *Cyperaceæ* and the dead trees, we met with. There was a fair amount of vegetation, but a perfectly amazing lack of variety. Considering the island's favourable situation from a climatic point of view, this barrenness is scarcely credible. Land-crabs simply swarmed all the way up, and I am bound to confess they did not make upon us the same weird impression that Mr. Knight

HEADLAND OF FRIABLE BLACK ROCK, TRINIDAD ISLAND.
(*From Sketch by Mr. Wilson.*)

experienced. Possibly we regarded them simply from a naturalist's point of view. Dr. Koettlitz and some of the men fed them at lunch-time, and of course we collected suitable specimens. Bird-life—especially petrels—was everywhere abundant. Birds hovered about our heads, and when we stopped, perched close beside us. They were quite easily taken by the hand, in butterfly-nets, etc.

On reaching the tree-ferns, I expected to find under their shelter a profusion of mosses, hepaticæ, lichens, etc., but even there the same

barren character was maintained. A few small ferns, fern prothallia, and some filamentous green growth, which may be the sporogonium of a moss or a small alga, were growing near the stream where it passed through the ferns. I cut down and brought with us a small tree-fern. The average height was from 12 to 15 feet, though I should say that a few were markedly higher.

My first impression was that the dead tree-trunks were the remains of a forest the trees of which had perished from some fungus or insect plague many years ago. They were very much in the condition Mr. Knight describes on the occasion of his visit twenty years ago. The wood is a very hard durable wood, and seemed to be very little invaded by fungus growth. Taken together with the general barrenness of the vegetation, I cannot escape the idea that some general destruction of vegetation has taken place in this valley, possibly over the whole island, and that its present condition represents a struggle back again to the normal state. There was no sign of the pigs and goats which at one time were landed on the island. One cannot help recalling the destruction of trees in St. Helena by goats as recorded by Mr. Darwin in the 'Voyage of the *Beagle*.' Has some such action taken place here with the result that the climate has been changed, and the general vegetation impoverished with a reaction involving the extermination of the goats themselves?

Our party reached the general rendezvous on the shore at 4.30, after an exhausting climb. The tide had risen, and we were cut off from the place of meeting by a high rocky point, which had to be climbed after an attempt by Captain Scott and myself to wade round it. Respect for specimens, camera, gun, etc., caused us to abandon this when we found the water breast-high.

Lieut. Shackleton, who had followed us, made an interesting and useful general collection and an acute series of observations. He obtained from a gannet's nest a specimen of a leguminous plant, no doubt the kind referred to by Mr. Knight as growing on the other side of the island, from which the bird had transported it. He took water-samples from the streams, and has since analyzed them, and obtained some photographs of birds and their nests. Like the rest of us, he was too heavily laden for climbing easily among the rocks.

Mr. Skelton made an adventurous journey by himself—a rash proceeding in such a place—eventually reaching a point where he could see across the island, though nowhere near the highest point. He went eastwards in the direction of the Monument, and steadily pursued his special task of observing and collecting birds and their eggs. In this he was particularly successful. On returning, he, on his part, was also cut off by the tide, and found himself in a very dangerous situation, where he could neither advance nor retreat. He managed to lower his gear, and then climb up the cliff and work his way round,

arriving just as the whole party was assembled. He had carried too much, and in the later stage of his journey suffered from cramp. His bag was 7 petrels and 4 eggs; 4 gannets and 3 eggs; 4 terns and 3 eggs. Unfortunately, these eggs were broken in the boat on returning.

On the reassembly of the whole party at the rendezvous, the tide was found to have cut us off from the "natural pier" mentioned—it was a very natural pier indeed—but it was safely reached through the surf, the first waders carrying out a line with them. As the faithful

GANNET'S NEST ON TRINIDAD ISLAND, 1100 FEET.

Cross led the way, I followed him, and we had the reward of our temerity in getting off very cheaply—the rest of the party thoroughly enjoying their varying fortunes. One member fought a little shy of the ordeal, and deservedly came off worst, to the huge delight of his friends. The whole party reached the *Discovery* at 6.10 p.m.

Lieut. Armitage had swung the ship during our absence, and Lieut. Barne had practised with sounding-gear, water-bottle, etc. Before setting out in the morning a fish-trap had been lowered and buoyed,

On hoisting it in, it was found to contain only the bait. Nothing was caught by the hand-lines from the ship—two negative results that are surprising after Mr. Knight's experience in the *Falcon* and that of our men in the boats close in shore.

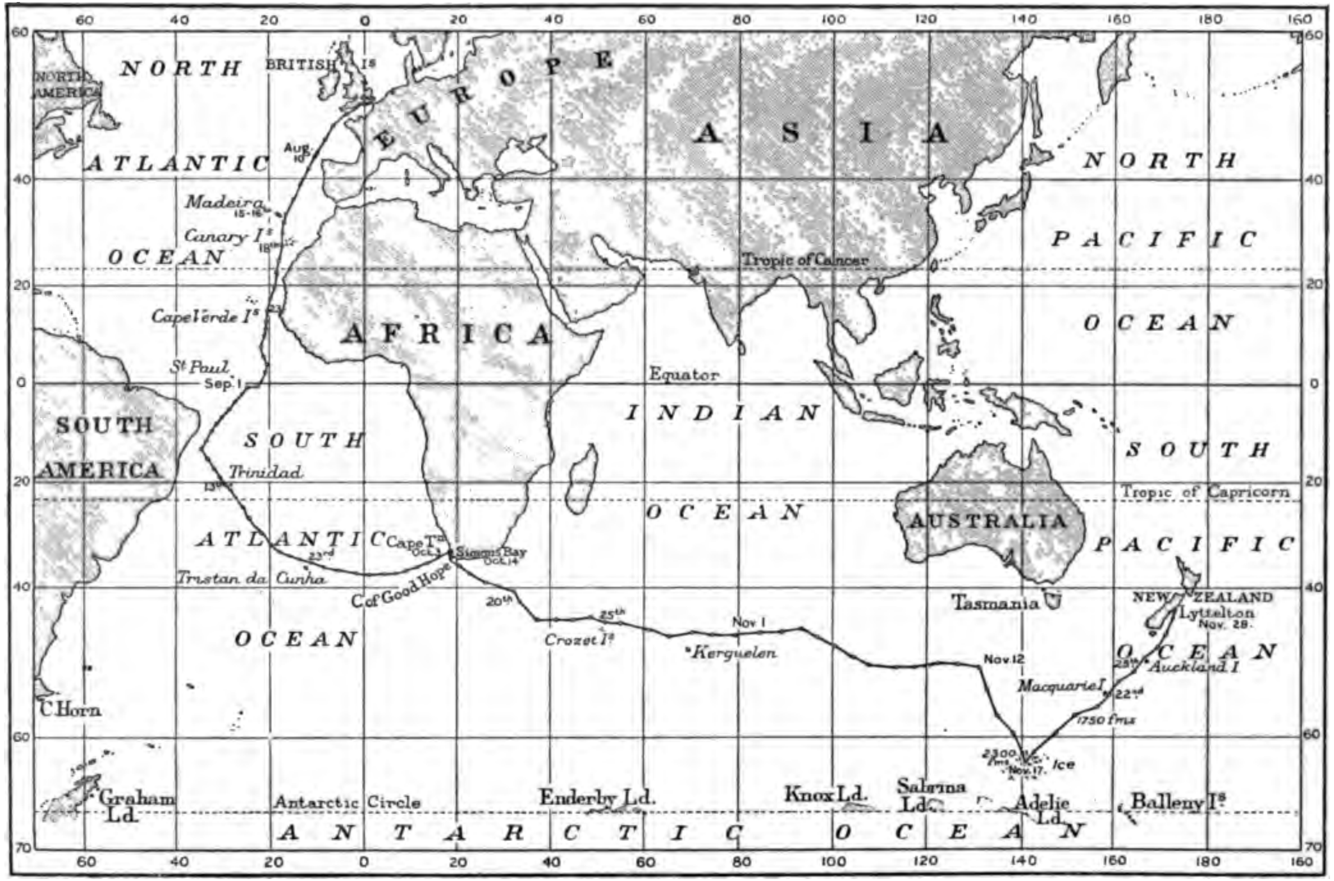
Mr. Ferrar made an interesting series of geological observations, and his specimens have been examined by Mr. G. T. Prior of the Mineral Department of the British Museum. Mr. Prior recently examined the specimens collected by Sir James Clark Ross on his outward voyage, and has, I fear, anticipated Mr. Ferrar's observations. In his paper in the *Mineralogical Magazine* (vol. xii. No. 58) he describes the Ninepin rock as of phonolite, and quotes Mr. Knight's description of the whole island as rotten and toppling to pieces—a very graphic description of the place. He goes in detail through the mineral structure of the island, and makes an interesting comparison of it with Fernando Noronha. "The characters of these rocks, as well as many of the geological features of the island, such as the remarkable peaks of phonolite associated with basaltic lavas, suggest analogies between Trinidad and the island of Fernando Noronha, off the coast of Brazil, a thousand miles to the north, so that it appears possible that the two islands owe their origin to a very similar, if not contemporaneous, volcanic outbreak." In a letter he says of Mr. Ferrar's specimens, "The rocks do not differ much from those collected by the Ross expedition," and in this department we have been unluckily anticipated.

I have already alluded to the extreme barrenness of the island from a botanical point of view. Two plants belonging to the Cyperaceæ, both endemic, clothe the valley we ascended. The predominant form is *Cyperus atlanticus*, Hemsl., and a rarer form is *Fimbristylis nesiotis*, Hemsl. Dr. Copeland, the astronomer, landed here in 1874, and collected a number of plants referred to in the *Challenger Reports*, Botany, iii. p. 123, by Mr. Hemsley. He was more fortunate in some respects than we. He obtained nine phanerogams, four ferns, and four lichens. The tree-fern, which forms so remarkable a feature of the higher ground, is *Cyathea Copelandi*, Kuhn and Luerss., also an endemic species. In addition to the ferns found by Dr. Copeland, we found three others, *Pteris palmata*, a *Nephrodium*, and another not yet determined, besides a moss (*Isopterygium*) and an Hepatic (*Eulejeunea*).

Even the fresh-water algæ from the cascade give barren results. We got three lichens, *Ramalia anceps*, Nyl., a West Indian form; *Usnea barbata*, var. *rubigina*, Meyer and Fest., a very widely distributed form; and *Parmelia latissima*, Fee, var. *insidiosa*, Müll. Arg., also widely distributed. The bean collected by Lieut. Shackleton from a bird's nest, and so often referred to by Mr. Knight in his later book, 'The Cruise of the *Alerte*,' is *Canavalia obtusifolia*, L., a widespread tropical form, also obtained on the island by Dr. Copeland.

Sir George Hampson informs me that it will take a long time to

TRACK OF THE S.S. "DISCOVERY," FROM COWES, AUGUST 6TH, TO PORT LYTTELTON, NOVEMBER 28TH, 1901.



work up the insects. Mr. Pocock furnishes me with the following note: "The spiders collected in the island of Trinidad are referable to five species, of which I have been able to identify only two—namely, *Heteropoda venatoria*, the ubiquitous house-spider of the tropics, and *Tetramatha nitens*, Aud., also a widely ranging tropical form. There are also two specimens of a *Plexippus*-like attoid spider, one example of species of *Aranea*, and several immature specimens of a species of *Leucauge*." Mr. Knight frequently refers to the land-crabs as "loathsome" and "unlike any I have ever seen," etc. They are quite common and widely distributed. The two crabs we found—and they made no terrible impression upon us — are *Gecarcinus lagostomus* and *Grapsus maculatus*. The fishes obtained by Mr. Hodgson and the men in the boats are: *Muraena punctatofasciata*, Blkr.; *Epinephelus merra*, Bl. *Glyphidodon bengalensis*, Bl.; *Platyglossus cyanostigma*, C. and V.; *Clinus nuchipinnis*, Q. and G.; *Acanthurus chirurgus*, Bl. Schn.; *Balistes buniva*, Lacép.; *Balistes maculatus*, Gm.; as determined by Mr. Boulenger. They are all well known, and call for no special remark.

The birds belong to seven species, of which one petrel appeared to be new to science, and Dr. Bowdler Sharpe had named it *Œstrelata wilsoni*. The other species, which was found nesting at a higher elevation than *O. wilsoni*, was *O. trinitatis*, a petrel discovered by the *Magenta*, and not hitherto represented in any museum in this country. The frigate-bird procured was, curiously enough, the smaller species, *Fregata ariel*, and not the larger one, *F. aquila*, which was the species met with on South Trinidad by the Earl of Crawford in the *Venus*.

Mr. Knight's description of South Trinidad as "the hottest, most depressing, and uncanny spot on earth" is no exaggeration, but the place, apart from its unfound piratical treasures, has a fascination for the naturalist that is not abated by the discomforts of travelling over it.

Perhaps the principal excitement of our southward voyage was the constant experiment with protected tow-nets. One evening I drew the plans of Mr. Blackman and myself of a torpedo-shaped protected net. Captain Scott summoned the carpenter, and it was at once put in hand. It answered fairly well, but the trials were hardly in progress before he began a fresh series of experiments with canvas covers instead of wooden shields. In fact, between microscopical work and tow-netting, I began to feel the captain was rapidly usurping the director's place, and it gave me unqualified pleasure to know that these departments would be so enthusiastically looked after when I had left the ship. The rival nets were still in competition when Captain Scott made a most important invention, viz. that of very long and very narrow nets without any protection. With these (which I shall describe elsewhere) we were able to tow-net up to 10 knots without any protection whatever. They were so successful that we for the time abandoned all the experiments with protected nets.

Two events relieved the monotony of the later stages of our voyage. One was the discovery by Dr. Koettlitz of a new Peridinian, which was named *Peridinium Scottianum* after our commander. The other was the capture by myself of a new generic type of pelagic unicellular alga. There was a general petition to call it after the ship, but I think the ship will yet be commemorated in this way, and I prefer, with the President's permission, to call this first generic type *Markhamia pelagica*.

Looking through my scientific diary, I find much to interest the naturalist—less of general interest, and in my private diary nothing that would be other than merely humorous.

III. THE "DISCOVERY" AND THE RELIEF SHIP.

By Sir CLEMENTS R. MARKHAM, K.C.B., F.R.S., President R.G.S.

When the National Antarctic Expedition left Simon's bay, it may be considered to have entered upon its real work. During the fifty-two days of the voyage thence to New Zealand experience was acquired respecting the adaptability of the ship to her work, respecting the qualifications of officers and men, and respecting the organization of all the various scientific investigations.

Favourable and hopeful reports on all these points cannot fail to encourage us in our hopes for the success of the great enterprise on which this Society has entered, in conjunction with the Royal Society.

First, with regard to the design of the ship. The spell of bad weather from October 27 to November 3, when a succession of westerly gales were experienced, was the first real test of the ship's seaworthy qualities. From this point of view she proved entirely satisfactory. At times it blew very hard, with heavy cross-seas, and the squalls burst in violent gusts of wind and hail or snow. It was found that the good ship rose easily and lightly to the heaviest seas, was wonderfully stiff under canvas, and surprisingly dry. Captain Scott had expected the possibility of shipping seas over the stern when running before heavy weather, and consequently some risk of broaching to. He was, therefore, agreeably surprised to find that no such danger exists. The ship has proved to be, in all respects, an excellent sea-boat. For this the Societies have to thank Mr. W. E. Smith, the designer, and one of the chief constructors of the Navy. He has given us his experience and his great abilities, almost as a labour of love, and has designed for us by far the best ship that ever entered the polar seas. He not only had to consider the lines of modern polar ships, but he also had to take into account the extreme difference of sea conditions between the

northern and southern polar oceans. Captain Scott attributes the ease with which the *Discovery* rises to heavy following seas entirely to the rounded shape of the stern, which he thinks will also give her a great advantage in the ice, notwithstanding the severe criticisms it met with at home. A good sea-boat is usually what seamen call "lively," and the *Discovery* proved anything but an exception to the rule. She was tossed about like a cork on the big seas, and rolls up to 43° have been recorded. Some nonsense has appeared in the newspapers about her

THE CROW'S NEST ON THE *DISCOVERY.*

excessive rolling. I should like to have the people who write about it on board a Symondite frigate off the Horn for a month. Then they would know what rolling is. The *Discovery* has never rolled a degree more than she is perfectly justified in rolling. Her greatest run during twenty-four hours was 223 knots, and 200 knots was exceeded on several occasions.

The question of the leaking of the ship is quite another matter, and is wholly unconnected with her design. It is a question of workmanship.

The leaking in the holds and engine-room had been continuous since the ship left England, and a bad leak had been sprung in the fore peak after entering the pack-ice. On reaching Lyttelton, she was making sufficient water to necessitate more than an hour's work at the hand-pumps daily. I cannot say anything, on the present occasion, about the blame, for the matter must be considered at present to be *sub judice*. But Captain Scott very properly would not start on his

THE GARSTANG NET.

antarctic voyage with the prospect of such continuous labour at the pumps.

The *Discovery* was taken into dock at Lyttelton in December, and the work was carried out by Mr. R. J. Miller in the most thorough manner possible. The ship was caulked throughout, and the leaks were practically stopped, except in the fore peak. Those interested in the Expedition, and especially the friends and relations of those on board, now have the satisfaction of knowing that the leak is no longer serious, and that the amount of water made forward in a day can be pumped out in ten minutes. For this result our cordial thanks are due

to Mr. Miller, and our other friends in New Zealand. You must clearly understand that there is absolutely no danger from the leak; only annoyance and a little extra labour. The holds are as full as it was possible to stow them, and the officers have absolute knowledge of what is on board and where each particular article is stowed. The ship contains provisions for two years and nine months, and by careful stowage they were able to start with 285 tons of coal in the bunkers, and a deck load of 65 tons, altogether 350 tons. On the upper deck were also 45 sheep and 23 dogs.

Captain Scott has proved himself to be the *beau ideal* of a polar commander. The Presidents of the two Societies have full confidence in his ability, judgment, and skill, and that he possesses those higher qualities which fit him to lead men in times of hardship and peril. We firmly believe that he will secure such a measure of success as the mighty powers of nature arrayed against him may render possible. We ask no more.

Our commander is an expert as regards some of the scientific subjects to be investigated, and those the most important; and he is specially fitted for the direction of the scientific work. It is a difficult position, requiring infinite tact and judgment, and no man is better qualified to occupy it. His principle is to leave each man a maximum amount of freedom in his particular duties, and it is one which will work admirably. As regards supervision, all that he requires is that each member of the scientific staff shall keep a summary of his work in the captain's cabin, and write it up weekly. These books are open to the inspection of all the others, so that each man knows at once where to get information respecting the work of other departments, and can correlate his own results at any time. With regard to special work that members of the scientific staff may wish to do, or points of interest that occur to them, the captain takes opportunities of talking it over with them, and they know that he is always willing to help their work when possible.

His method has borne the test of success, and nothing can be more satisfactory than the genuine feeling of loyalty and good comradeship that exists throughout the expedition.

The executive officers have now acquired the only thing they needed, which was experience. It was said that they were too young and inexperienced. This can be said no longer, for out of 115 days since leaving England, they have spent 107 at sea, and most of them under sail. Lieut. Royds, especially, has shown that he possesses all the qualities of a seaman. The men are thoroughly up to their work, and, with a knowledge of the arduous character of the service, are in the keenest spirits to undertake it. They understand the situation, and with them there will be no difficulty, under such a leader, in enforcing disciplinary measures for purposes of health or with

other objects. Amongst the officers there has not been a single disagreement during their voyage of 15,000 miles.

Lieut. Armitage, with Lieut. Michael Barne as his assistant, has charge of the magnetic observations. All that he does is well done, and his sound judgment is never at fault. It was to secure some important magnetic results that the *Discovery* shaped her course to the southward in about 130 E. Here was supposed to be the centre of magnetic intensity. The first ice was, of course, an important event. It always has been so in polar voyages. I remember inducing the present Captain Egerton to charge his first ice on board the *Alert*. But it was rather a formidable piece, and brought the ship up all standing. Sir George

LOOSE PACK-ICE.

Nares was not best pleased. But there was no such danger in the *Discovery's* first ice. Michael Barne was officer of the watch, on a dull snowy morning, and he gleefully shouted, "Ice on the port bow!" It was a piece about 2 feet square. Soon after the good ship was christened by a fair-sized piece striking her bows. It was on Saturday, November 16. At noon they met long streams of ice, and in the afternoon a sounding was taken, bottom being reached in 2200 fathoms. Lieut. Barne has charge of the sounding operations. In the first watch they reached a close pack of ice, and were obliged to turn the ship's head to the north, much pleased and interested by their ice experience. It has given all on board great confidence in the ship, and in the way she forced herself through ice many feet thick. It is a point of considerable

interest that, with the exception of a small berg piece, no icebergs were seen on this meridian either within or outside the pack. Captain Scott touched at Macquarie island on the way north to New Zealand, in order to make collections, reaching Lyttelton on November 30.

The work apportioned to the officers, in addition to watch-keeping and their scientific duties, will interest the meeting. Royds has charge of the upper deck and of all the top hamper on the skids, for the security of which, in the long succession of bad weather, he merits the highest credit. Barne has the ward-room and lower deck. Shackleton has the galley compartment, and charge of all the stores, issuing them each day at four o'clock. He also goes round to the men's tables every day, to see that they are satisfied, and to give them frequent opportunities of making any complaint. Skelton, though fully occupied with the work of the engine-room, also takes charge of the dark room, and stores all negatives of interest. Dr. Wilson has a marvellous capacity for work, while his really wonderful artistic talent will be invaluable. But all are equally good and equally zealous, happy among themselves, and full of loyalty to their chief.

I cannot refrain from mentioning a proof of Lieut. Armitage's excellence as a navigator. They sighted Macquarie island exactly at the time and in the direction expected—a very satisfactory fact after a voyage of fifty-two days without having once sighted land during the whole time.

The meeting will be interested to hear some details of the scientific work that has been done by our explorers during their voyage from the Cape to New Zealand. It is true that some of it is tentative, and that there will be completer results when more experience has been gained; nor have the full reports yet reached us. But it all shows the zeal and intelligence with which our explorers are working, and gives rich promise of future results.

The magnetic observations have been continuous over a long and important line, and have also been carried south to 63°. This valuable work was conducted under the greatest difficulties, for the lurching and "sending" (or bodily transference) of the ship affects the inertia of the magnetic needles, and is especially disadvantageous to the observations. The object of going south more or less in the line of no variation was to observe the changes of force. The observations seemed to show a very gradual increase of force as the pole was approached. There are other points of interest in the observations for dip and variation, but the full report has not yet been received. Lieutenants Armitage and Barne, as magnetic observers, were reinforced at New Zealand by their colleague Mr. Bernacchi, with the self-registering *eschenhagen* instruments. Mr. Bernacchi, as a zealous, untiring, and intelligent observer, is a great acquisition. Moreover, he not only unites with his colleagues in loyalty to Captain Scott, but speaks of him, in his letters, in terms of warm affection.

The meteorological report and observations have not yet reached us, but we know the conscientious steady way in which Lieut. Royds keeps the records, and we may feel sure of good results from such a first-class worker. Mr. Shackleton continued his determinations of the specific gravity of sea-water throughout the voyage, obtaining samples twice a day, and using two methods—that of specific-gravity determinations by Buchanan's hydrometer, and that of chlorine determinations. Mr. Ferrar took great pains with his observations for electricity in the atmosphere, but it is most difficult to charge or keep the instrument

WAKE OF THE *DISCOVERY* THROUGH THE PACK.

charged at sea. He also worked at the atmospheric carbonic anhydride determinations by the method suggested by Prof. Letts.

Lieut. Barne has charge of the deep-sea sounding apparatus. On three consecutive days, November 15, 16, and 17, soundings were obtained in 2530, 2380, and 2360 fathoms in latitudes 59° 35′, 62° 20′, and 61° 42′ S., and another in 1740 fathoms in 56° 8′ S. But the sounding-machines when supplied were out of adjustment, and they can only be properly adjusted by experimenting with them, so that much fuller and more complete results may be expected hereafter. The Hansen-Pettersen water-bottles will also be of great value, and they will enable the explorers to ascertain the existence of warm and cold layers of water in the ocean depths. Two of these valuable instruments have been supplied by the Antarctic Finance Committee, and one by the Admiralty.

The materials brought up by the sounding-tube, after the four deep-sea soundings, were carefully examined by Mr. Ferrar, who has made a report describing the results of his examinations.

Mr. Hodgson's biological work has been confined to the *plankton*, as exigencies of time rendered it necessary to make passages, and made it impossible to arrange the stoppages for biological work which were originally intended. Even the orthodox gear for *plankton* could not be used when the ship was going more than 7 knots. In order to remedy this state of things, Captain Scott devised a small tow-net 3½ inches in diameter, which answered the purpose well. Several were made on board, and have been in constant use. For *protozoa* and *protophyta* these high-speed nets have proved invaluable, but for the larger and more bulky organisms, only a few could bear the strain. Delicate animals were hopelessly crushed. The *amphipoda* seem to have stood best, and form the most important part of the collections. Of course, there will be a very different state of things when the ship begins its real work in the Antarctic regions, without the necessity of making passages. A collection register will be kept throughout the voyage, and Mr. Hodgson will work through the collections during the winter, identifications being recorded in the proper places in the register. The collection of *plankton* during the voyage from the Cape to New Zealand has been sent home in 102 tubes enclosed in twelve bottles, with a full report on the specimens. Dr. Koettlitz has sent home a report on the *phyto-plankton;* Captain Scott reports that both these members of the scientific staff have worked zealously, and have done their best under very difficult circumstances.

A good ornithological collection was made both in the ice and at Macquarie island. Six different kinds of fulmars and petrels were obtained while the ship was among the ice in 63° S. Before reaching New Zealand, Captain Scott came to the wise decision that it would be desirable to devote a few hours for landing at Macquarie island, a spot of great interest to the naturalist. So he anchored at Fisherman's cove, within half a mile of the shore.

The island on the east side is green, owing to a luxuriant growth of tussach grass, but the western faces of the hills were wind-swept and bare. It is about 22 miles long by 5 broad. A considerable portion was explored by Mr. Ferrar, who has sent home a report on the geology, and collected geological specimens. He discovered raised beaches showing the periods of rest in the elevation of the island, and he describes other points of geological interest observed during his excursion inland.

With regard to the fauna, there were two extensive penguin rookeries, where the birds were in thousands, and of two species—the King penguin and the gold-crested broad-billed kind. Arriving in the breeding season, the naturalists were able to collect the birds in various

PENGUINS ON MACQUARIE ISLAND.

stages of maturity, as well as their eggs. Specimens of the southern skua, the giant petrel, and a black-backed gull were also collected. Mr. Hodgson shot about ten landrails, known as the "Rothschild rail," which I understand are rare. Whilst many of the party were engaged in making zoological collections, Dr. Koettlitz obtained a considerable number of botanical specimens, and at 8 p.m. the shore-parties returned to the ship. The results are that six cases of bird-skins have been sent home; and a case containing pressed plants, tubes of fresh-water algæ, fungi, worms, and insects, and geological specimens.

The visit to Macquarie island offered the first opportunity for the explorers to become acquainted with the taste of penguin flesh. On Sunday, November 24, a penguin stew was prepared, and Armitage wanted to cook it in Worcester sauce, a glass of Madeira, and a glass of port. But Shackleton and Wilson, the mess and wine-caterers, declared that the stores would not stand such waste, and the penguin had to be cooked without that epicurean sauce. Shackleton pronounced it to be all right, and that it had the merit of being fresh, but he would not ride a mile to eat it. Royds highly approved of scrambled penguins' eggs for breakfast, and thought the roast penguin at dinner very good. The men had it boiled. Some liked it and some did not. Captain Scott had anticipated considerable prejudice on the part of the men to this form of diet, which it will so often be necessary to enforce, and he was agreeably surprised to find that they were by no means averse to it. Many pronounced it excellent, and all appreciated the necessity of cultivating a taste for it.

I look upon this memorable voyage, with its wild weather inuring our young explorers to rough practical seamanship, with its opportunity of first seeing the streams of Antarctic ice, with its visit to a sub-Antarctic island, as the first training-ground of the Expedition. Here the first eagerness for hard work and novel scenes were in some sort gratified. In imagination we see our young, but no longer inexperienced, explorers imping their scientific wings, and preparing for higher flights in the vast region of the unknown South.

How anxiously we all hope that these preparations were an earnest of all the success that we and they can desire! We cannot know or hope to know what obstacles they have met for a long time, but all we know of this long voyage, and of their work during those fifty-two days, fills our hearts with confidence—with confidence in the high qualities of officers and men, and, above all, with confidence in their able and trusted leader.

From Macquarie island the *Discovery* proceeded to the northward. On the morning of November 25 Auckland island was sighted, and on the 29th they reached the harbour of Lyttelton.

Nothing could exceed the kindness and hospitality of the people of Lyttelton and Christ Church, and the interest taken in the expedition throughout New Zealand. It amounted to enthusiasm. There is good reason to hope that the colony, following the noble example of Queensland, will vote a grant of money towards the expenses of the Expedition. The two Societies owe their special thanks to our associate, the Hon.

OFFICERS AND STAFF OF THE *DISCOVERY* LEAVING NEW ZEALAND.

C. C. Bowen, who has long advocated the passing of such a vote; to Mr. Coleridge Farr, of the magnetic observatory at Christ Church; to Mr. Miller, who stopped the leak; to Mr. Rhodes, whose hospitality was unbounded; and to Mr. Waymouth, the Managing Director of the Frozen Meat Company, and Chairman of the Harbour Board. All harbour and dock dues were remitted, and everything was done by these gentlemen and others to further the objects of the Expedition.

And so, with all these kind attentions and cordial good wishes at the last port, the memories of which will long be cherished by them, our gallant explorers have sailed forth into the unknown. By this time

LAST VIEW OF THE *DISCOVERY* FROM LYTTELTON.

the *Discovery* has passed through the pack, and had many encounters with the ice. Exactly sixty years ago to-day, Sir James Ross reached his furthest eastern point along the great ice-barrier. He saw the appearance of land far to the east, but the bay ice was beginning to form. We hope that, with the help of steam, the *Discovery* has already done much more. But we can only hope. A long and weary and anxious time must elapse before we can know. Those gallant men we have sent forth to add lustre to the annals of their country are now facing perils and hardships of no ordinary character. We, who have sent them, are sitting comfortably at home. But we have a duty, a bounden and urgent duty, which we cannot shirk. We must see that sufficient funds are subscribed for the despatch of the second ship—the relief ship.

I hear that it has been said that the second ship is an afterthought. An afterthought indeed! Why, I have been urging the necessity of sending a second ship after the first winter of every polar expedition for the last thirty years. The terrible Franklin disaster was due to the neglect of this precaution. It has always been taken since. In 1875 I wrote a pamphlet on the subject, which induced the Government of that day to engage Sir Allen Young to go in search of Sir George Nares's expedition in the *Pandora*. In 1881, when Mr. Leigh Smith did not return, we applied to the Admiralty, and at once obtained a grant of £5000 and permission to employ naval officers.

If such a precaution is necessary in the arctic regions, it is assuredly most imperatively necessary in the antarctic regions. It was an essential part of the original scheme. In the last appeal for funds, signed by the Presidents of the two Societies, we asked for £120,000, and the cost of the relief ship was included in our estimate. But Captain Scott's own words are decisive on the necessity for a relief ship. In his letter of December 17, he writes, "I had contemplated writing to you most urgently on this subject, knowing how absolutely our retreat would otherwise be cut off should any accident result in the loss of the *Discovery*. The conditions which surround the antarctic lands with a belt of tempestuous ocean have always impressed me with their difference to those existing in high northern latitudes, and I have felt that, since our retreat by boats is a practical impossibility, our movements and the risks we could rightfully take must be greatly limited, if the loss of the ship of necessity implied the loss of all on board. Though I understand that the funds for a relief ship are not yet fully subscribed I see that its objects are thoroughly considered, and that every effort will be made to despatch, at the right time, the vessel which you have already purchased for the purpose. It will, therefore, be a great relief and satisfaction to me to leave Lyttelton, confident that such efforts will be successful, and that a line of retreat is practically assured us."

With this firm faith in their countrymen, our gallant explorers have entered the unknown. How can there be any answer but one to such an appeal? Captain Scott has given us details of his arrangements, and named places where depôts are to be stored. He knows that, in the possible event of the loss of the ship, all hands must perish unless succour is sent. Is it to be sent or not? Imagine a retreating party, with extreme difficulty and in terrible distress, reaching the place for one of these proposed depôts, in full hope and confidence, and finding—nothing; that their countrymen would not subscribe the funds. Such an event is too horrible to contemplate.

I do not believe a word of it. I have worked hard to collect funds in spite of refusals, rebuffs, and snubs; but I still have a firm belief in the generosity, humanity, and patriotism of the majority of my

countrymen. If a relief ship is sent, there is no undue risk; but it *must* be sent, and the funds must be raised. There are now several zealous workers who are leaving no stone unturned, and are confident that the necessary amount will be forthcoming. Within the last fortnight there have been several hopeful signs.

Last week H.R.H. the Prince of Wales, Vice-Patron of the Expedition, sent for me to tell him what had been done with a view to the despatch of the relief ship. As a sailor, and as a patriotic Englishman, His Royal Highness saw the necessity for raising the necessary funds and affording the needful succour to our explorers, and he sent a liberal subscription. The Royal Society, with the same conviction, has subscribed £500. The Goldsmiths' Company has set what may prove to be an important example, by subscribing £200. The Fishmongers' Company has subscribed £100. Our second appeal to the Fellows has brought in a considerable sum, and I hope will continue to do so. Our very cordial thanks are due to the numerous liberal subscribers, yet even now, out of 4020 Fellows only 400 have subscribed.

After a careful consideration of the various recommendations of the few wooden ships at Dundee and in Norway which still exist, I came to the conclusion that the *Morgen* (or *Morning*) of Tonsberg, in Norway, was the only one that would at all answer our purpose. Her name has not been changed, because it is very unlucky to change the name of a ship, especially of a Polar ship. She was built in 1871, but as she is perfectly sound her age is no disadvantage. The old *True Love*, a whaler well known to me when I was in Baffin bay, was then sixty years old, and as sound as when she was launched. When she was broken up at the age of one hundred years, her timbers were so sound and good that they were not used for firewood, but sold to Blundell Maple to make choice oak furniture. I had known the *Morning* since 1897, and at one time I thought of her as the ship for the main expedition. She is a vessel of 450 tons, and of quite remarkable strength; indeed, I should think the strongest whaler that was ever built. In one respect she is too solid, for she draws so much water when empty, that she may not be able to carry the quantity of coals and stores that we should be led to expect from her tonnage. However, she is the best vessel to be had, and, with the approval of our Council, I bought her and had her brought across to the Thames. She is now in the hands of Mr. Green for necessary alterations. In our associate, Mr. William Colbeck, of the Royal Naval Reserve, an efficient and zealous commander has been found, who is already acquainted with Antarctic ice navigation; and I believe that he will be able, without much difficulty, to select capable officers and a good crew from the numerous volunteers. Captain Scott has given us his wishes in detail, with regard to the procedure of the relief ship, and the carrying out of those wishes will largely be left to Mr. Colbeck's discretion. All we need are the funds for the equipment and despatch of the *Morning*.

I entreat all present to remember that our gallant friends are now braving hardships and dangers for science and for their country's credit, *and at our behest;* that they are working in full faith and belief in us and that we will send them succour; and that we are all bound, in our different spheres, to work for the great end of collecting sufficient funds to send out the relief ship next June.

APPENDIX.

FINAL LIST OF OFFICERS AND CREW OF THE "DISCOVERY" WHO ENTERED THE ICE.

1. *Commander*—ROBERT FALCON SCOTT, born June 6, 1868. He entered the navy in 1886. In the *Rover* (Training Squadron) for a year, 1887–88. With Captain Hulton in the *Amphion*, 1889; and navigator in the *Sharpshooter* when Captain Auton reported him to be "a good navigator, zealous and attentive." Torpedo lieutenant serving under Captains Hall, Durnford, Robinson, and Jackson. He was four years in sailing ships, Torpedo lieutenant of the *Majestic*, 1898–99, when Captain Egerton strongly recommended him for the Antarctic command. He went through a special *course of surveying*, 1892–93; and for magnetic observations, 1900. *Commander*, June 30, 1900. M.V.O., F.R.G.S.

2. *Navigator and Second in command*—ALBERT B. ARMITAGE, *Lieut.* R.N.R. Chief officer P. and O. service. Born July 2, 1864. *Worcester cadet* 1878. 1894–97 he was the scientific observer in the Jackson-Harmsworth Expedition, and saw much ice navigation and sledge travelling. On June 5, 1899, he received the *R.G.S. Murchison Award.* In charge of the magnetic observations.

3. *First Lieutenant*—CHARLES W. RAWSON ROYDS, born February 1, 1876. Nephew of Admiral Sir Harry Rawson, and of Commander Wyatt Rawson, the distinguished Arctic officer. *Conway cadet.* In the *Champion* (Training Squadron) under Captain Cross; then in the destroyer squadron at the Nore under Commander de Robeck; then in the *Crescent* flagship, W.I. *Lieutenant* R.N., F.R.G.S. In charge of the meteorology, and went through a course of magnetic instruction. Musician, vocal and instrumental. He is a thorough seaman. He went to the Ben Nevis Observatory during the winter 1900.

4. *Second Lieutenant*—MICHAEL BARNE, born October 15, 1877, *Lieut.* R.N. Served in H.M.S. *Majestic* and in China. He went up to the Ben Nevis Observatory during the winter 1900, and through a course of magnetic instruction. Assistant magnetic observer, and in charge of the sounding apparatus. Also in charge of the wardroom and men's deck.

5. *Third Lieutenant*—ERNEST SHACKLETON, born November 4, 1874. He entered the merchant service in 1890, and served in sailing ships in the Pacific, afterwards in the *Castle* line. *Sub.-Lieut.* R.N.R., F.R.G.S. In charge of sea-water analysis. Ward-room caterer. In charge of the holds, stores, and provisions, and arranges and serves out provisions. He also arranges the entertainments.

6. *Engineer*—Reginald Skelton, born June, 1872, Engineer R.N. Photographer, charge of dark room and negatives. In charge of the dynamo apparatus, condensing, &c.

7. *Surgeon and Botanist*—Reginald Koettlitz, born December 23, 1861, student of Guy's. In country practice seven years. 1894-97 he served in the Jackson-Harmsworth Expedition as surgeon. An expert as regards phyto-plankton. Bacteriologist. His bacteriological apparatus was presented to him by former students of Guy's Hospital. In charge of the port laboratory.

8. *Surgeon and Vertebrate Zoologist*—Edward Wilson, born July 23, 1872. Surgeon at Cheltenham. M.B. In charge of the xanthometer. Dr. Wilson possesses great artistic talent both for painting landscapes and animals. He is wine-caterer.

9. *Physicist and Magnetic Observer*—Louis C. Bernacchi, born Nov. 8, 1876, in Tasmania. Two years at the Melbourne Observatory. Magnetic and Meteorological Observer in the Newnes Antarctic Expedition. Author of a paper on the "Topography of S. Victoria Land" read at the R.G.S. meeting on March 18, 1901, and of 'To the South Polar Regions,' a narrative of his Antarctic experiences. He went out with the Eschenhagen magnetic instruments, joining the *Discovery* in New Zealand. F.R.G.S.

10. *Biologist*—J. V. Hodgson, born Feb. 19, 1864, in Birmingham. He had been curator of the Plymouth Museum. In April, 1901, he went for a cruise in the Norwegian dredging and sounding vessel *Michael Sars*. In charge of the starboard laboratory.

11. *Geologist*—H. J. Ferrar, born on June 28, 1879, at Dalkey, co. Dublin. A Cambridge graduate and geologist. In charge of the atmospheric carbonic anhydride determinations suggested by Prof. Letts. In charge of the laboratory on the lower deck.

12. *Assistant Engineer*—J. H. Dellbridge, aged 29. Artificer in the engine-room, and attends to the top hamper on the skids. From H.M.S. *Majestic*. R.N.

13. *Boatswain*—J. Alfred Feather, aged 31, born at Great Yarmouth. Came from H.M.S. *Boscawen*. Attends to the top hamper on the skids, under Lieut. Royds. R.N.

14. *Carpenter*—Frederick C. Dailey, aged 28, born at Portsmouth. From H.M.S. *Ganges*. Served his apprenticeship in a wooden shipyard. Reported on the condition of the hull of the *Discovery* with regard to the leaks at Lyttelton. R.N.

Petty officers, 5 (*all naval*).

15. Edgar Evans, aged 26, born at Swansea. Came from H.M.S. *Majestic*. R.N.

16. David Silver Allan, aged 30, born at Montrose. Came from H.M.S. *Majestic*. *Married*. R.N.

17. Jacob Cross, aged 25, born at Little Clacton. R.N.

18. William Macfarlane, aged 27, born at Forfar. R.N.

19. Thomas Kennar, aged 26, born at Brixham. Came from the *Magnificent*. R.N.

Able seamen.

20. William Smythe, aged 27, born at Portsmouth. Came from the *St. Vincent*. R.N.

21. JAMES W. DELL, aged 23, born at Worthing. Came from the *Pembroke.* Plays the mandolin. R.N.

22. WILLIAM L. HEALD, aged 25, born at York; instructed in ballooning at Aldershot. R.N.

23. WILLIAM PETERS, aged 22, born at Cork. Came from the *Magnificent.* R.N.

24. ARTHUR PILBEAM, born at Worthing; home at Hastings. Came from the *Mars.* R.N.

25. FRANK WILD, aged 28, born at Skelton, Yorkshire; home at Eversholt, near Woburn. Came from the *Vernon.* R.N.

26. THOMAS SOULSBY WILLIAMSON, born October 6, 1877, in Sunderland. Came from the *Pactolus.* R.N.

27. GEORGE BEAVER CROUCHER, from Grimsby, aged 20. Joined from the *Narcissus* at Cowes. R.N.

28. ERNEST EDWARD MILLS JOYCE, aged 26. Joined from the *Gibraltar* at Simon's bay. R.N.

29. GEORGE THOMAS VINCE, aged 22. Joined from the *Beagle* at Simon's bay. R.N.

30. THOMAS CREAN, aged 25. Joined from the *Ringaroona* at Port Chalmers, N.Z. R.N.

31. JOHN WALKER, aged 24, born at Dundee. *Married. Merchant service.*

32. *Shipwright*—JAMES DUNCAN, aged 31, born in Perthshire. *Married. Merchant Service.*

Leading Stokers, 6 (5 naval).

33. ARTHUR E. QUARTLY, aged 28. Joined from the *Majestic.* R.N.

34. WILLIAM LASHLY, aged 33, born at Hambleton, Hants. From the *Duke of Wellington.* He was instructed in balloon work at Aldershot. *Married.* R.N.

35. THOMAS WHITFIELD, aged 32, born at Newport, Salop. Joined from the *Resolution.* R.N.

36. WILLIAM PAGE, aged 25, born at Berwick-on-Tweed. Very strong, and sings a good comic song. Home at Sheffield. R.N.

37. FRANK PLUMLEY, aged 26. Joined from the *Gibraltar* at Simon's bay. R.N.

38. WILLIAM HUBERT, aged 35, from Poplar. An engine-room artificer and donkey-man. *Married. Merchant Service.*

Royal Marines, 2.

39. ARTHUR HARRY BLISSITT, aged 23, born at Grantham. Home at Brigg, Lincoln. Lance-corporal. *Ward room domestic.* R.M.

40. GILBERT SCOTT, aged 23, from Stapleford, near Salisbury. *Ward room domestic.* R.M.

41. *Ship's Steward*—CHARLES REGINALD FORD, aged 23, born in London. From the *Vernon.* R.N.

42. *Cook*—HENRY R. BRETT, aged 35, shipped at Lyttelton. *Married. Merchant Service.*

43. *Cook's Mate*—CHARLES CLARKE, aged 24, born at Aberdeen. A baker by trade. Cook at Ben Nevis Observatory. *Merchant Service.*

ratory Attendant—HORACE C. BUCKRIDGE, aged 25. Joined at Simon's ay. He had served in the Boer war, and had been a great wanderer. *Civilian.*

—CLARENCE HARE, aged 21, son of a banker at Christ Church. Joined at Lyttelton. *Civilian.*

Attendant—F. C. WELLER. Had been a sailor in the merchant service. Plays the mandolin. Good at singing comic songs. Joined at Lyttelton with the dogs. *Merchant Service.*

ANALYSIS.

46 souls.

29 Naval (4 officers, 27 men) 2 Marines 2 Naval Reserve	 33	46
2 Surgeons 3 Civilian Scientific Staff	 5	
6 Merchant Service * 2 Civilians (*Laboratory attendant and clerk*)	8	

38 *Single.*
8 *Married*—1 Lieut. R.N.R. (*Armitage*).
2 Surgeons (*Koettlitz* and *Wilson*).
1 Petty Officer R.N. (*Allan*).
1 Stoker R.N. (*Lashly*).
3 merchant seamen (*Duncan*, *Walker*, *Brett*).

Of the crew—29 English 5 Scotch 1 Irish Officers—9 English 2 Irish	38 English. 5 Scotch. 3 Irish.

After the reading of the papers, Dr. BOWDLER SHARPE said: I shall be very happy just to say a few words about the collection which has arrived at the British Museum from the *Discovery*, and which has turned out to be an excellent and interesting one. All these Oceanic islands are the refuges and places where the petrels breed. In ordinary times and for a great part of the year, these petrels are distributed over the sea, very much in the same way as other birds are distributed over land areas, and the difficulty we have is to find where the nesting-places of some of these birds are. Kerguelen island, for instance, is a great place for the nesting of petrels, and many of the West India islands are the homes of petrels in the breeding-season. In most cases they go to very high altitudes, the highest they can get on these islands, and nest on the rocky ground. Wherever you find these Oceanic islands, it is almost safe to predict that there you will find the nesting-home of some kind of petrel or other. Some petrels, I may add, are so rare—like the Capped petrel, for instance—that we only know about five specimens of this bird, and nobody knows to this minute where it nests, although it is a bird that has been found in our own country. South Trinidad is a very interesting place.

* 1 seaman. 1 donkey-man, 1 shipwright, 2 cooks, 1 dog attendant.

Dr. Giglioli found two species of petrel on the island, one of which they called *Œstrelata trinitatis* and the other is *Œ. arminjoniana*. The first was found by the naturalists of the *Discovery*, high up on the hills of this island, and, not knowing that it was such a very rare bird, they did not bring home so many specimens as I should have liked, but they brought home a bird and eggs which were quite new, and which I had never seen before. Also they got another bird which I at first said was *Œ. arminjoniana*, but, however, it is not; it is quite a different species. They brought six specimens, and several eggs, and I have called it *Œ. wilsoni*, after the naturalist on board the *Discovery*. At any rate, it is a very auspicious beginning of the voyage that at the very first place on which they have landed they have got birds which we had not in the British Museum, and I may tell you that that is a very difficult thing to do; and they also got a new species. I should like just to add one word, before sitting down, to the meed of praise which the President and Dr. Mill and Mr. Murray have given to the naturalist and officers on board this ship. Dr. Wilson, as you will see from the sketches in the other room, is a very capable artist, and that is a point of great importance when you have a naturalist on board a ship who is able to correctly colour the bills and feet of birds, and that he does in a most admirable manner. In a few weeks will be published the Report on the collections of the *Southern Cross*, and there will be some most excellent pictures which Dr. Wilson has done for this Report. Before he went, he spent a long time working with us in the Museum at the mammals and birds he was likely to have to work on with the *Discovery*. It is owing to the loss of the notes made by the excellent naturalist of the *Southern Cross*, that Dr. Wilson has now to do over again all the work which poor Hansen had done in so able a manner. Dr. Wilson has gone with fuller knowledge than any man has possessed about seals in the antarctic regions, and from the way he has begun we may look forward to very satisfactory results—results which will reflect not only great credit upon himself, but on the whole of the Expedition.

The PRESIDENT: We have had two very interesting addresses, giving us an account of the voyage of the *Discovery* to Simon's Bay, from Dr. Mill and from Mr. George Murray, and I am sure the meeting will wish to pass a unanimous vote of thanks to them for their communications. We are also very much obliged to Dr. Bowdler Sharp for his remarks. I will not invite any further discussion, for my mind still turns to that deeply laden ship as it left Port Chalmers, and to the duties we owe to it. I cannot express to you the anxiety I feel, and which I trust many others share with me, with regard to raising the necessary funds for the relief ship. The other day I received a subscription from a little boy, of 5*s.*; I heard afterwards that he was saving up his pocket-money to buy a bicycle. Now, there was not only generosity in this, but there was very considerable self-sacrifice, and I am sure it ought to be a lesson to all of us grown-up people. You will find in the tea-room, not only the model of the *Discovery*, by which you can study that form of the stern mentioned in Captain Scott's despatch, and many sketches and interesting photographs, but you will also find there a subscription list, by which those who entertain the same feelings as I do—and I am sure there must be many here who do—will be able to add their names to the subscriptions for the relief ship.

THE GLACIERS OF KANGCHENJUNGA.*

By DOUGLAS W. FRESHFIELD.

THE Himalayan explorations on which I propose to base a few observations this evening were made in the autumn of 1899—two years ago. I have delayed offering any account of them to this Society for what has seemed to me a sufficient reason. It would have been easy, at an earlier date, to entertain you with a picturesque tour. But I was desirous not to talk about my travels to an audience which comprises at least a proportion of geographers, before my companion, Prof. Garwood, and I had had time to work out some of our results, and in particular to prepare a map, which, in contrast to its predecessor, the official survey, might, if incomplete in some portions, serve at least to indicate approximately what have never been indicated before—the glacial features of the Kangchenjunga group.

To this task Mr. Garwood has given infinite pains and patience. Using as a basis the trigonometrical determinations of the positions of the great peaks made in the course of the Survey of India or of local surveys, he has filled in and corrected the often vague or incorrect detail of existing maps by means of plane-table and other observations with the aid of the numerous photographs taken by Signor V. Sella and himself.

For nearly half a century I have been familiar with the Alps; I have visited more than once the Apennines and the Pyrenees, and have explored much of the Caucasus. I desired to see, before it was too late, some corner of the greatest mountain system in the Old World, the Himalaya.

Let me begin by explaining my reason for selecting Sikhim in preference to the Western Himalaya, where Sir Martin Conway went, and Mr. Mummery disappeared. For a traveller in search of the picturesque, a mountain's height must be measured from its visible base. The vale of the Rungeet, the visible base of Kangchenjunga in the Darjiling view, is 27,000 feet below its summit. The vast extent of the slope embraced in a single prospect gives unique sublimity to the landscape as a whole; while the succession of belts of vegetation piled one upon the other adds exquisite variety to the foregrounds through which a traveller approaches the snows. He sees at one glance the shadowy valleys from which shining mist-columns rise at noon against a luminous sky, the forest ridges, stretching fold behind fold in softly undulating lines—dotted by the white specks which mark the situation of Buddhist monasteries—to the glacier-draped pinnacles and precipices of the snowy range. He passes from the zone of tree-ferns, bamboos,

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* Read at the Royal Geographical Society, December 9, 1901. The map illustrating Mr. Freshfield's journey will be published with an explanatory note in an early number, together with Prof. Garwood's address.

orange-groves, and dal forests, through an endless colonnade of tall-stemmed magnolias, oaks, and chestnut trees, fringed with delicate orchids and festooned by long convolvuluses, to the region of gigantic pines, junipers, firs, and larches. Down each ravine sparkles a brimming torrent, making the ferns and flowers nod as it dashes past them. Superb butterflies, black and blue, or flashes of rainbow colours that turn at pleasure into exact imitations of dead leaves, the fairies of this lavish transformation scene of Nature, sail in and out between the sunlight and the gloom. The mountaineer pushes on by a track half buried between the red twisted stems of tree-rhododendrons, hung with long waving lichens, until he emerges at last on open sky and the upper pastures—the alps of the Himalaya—fields of flowers: of gentians and edelweiss and poppies, which blossom beneath the shining storehouses of snow that encompass the ice-mailed and fluted shoulders of the giants of the range.

If there are mountains in the world which combine as many beauties as the Sikhim Himalaya, no traveller has as yet discovered and described them for us.

Every journey is the better for having a distinct and feasible aim, and I made mine the tour of Kangchenjunga and the exploration and delineation of its glaciers. I was recently asked, and that in a literary club, what and where Kangchenjunga is, whether it is a mountain or an island? I would not venture to impute similar uncertainty to any Fellow of this Society; but, observing that there are strangers present, I may perhaps venture briefly to remind them that Kangchenjunga is a mountain, that it is 28,156 feet in height—is therefore the third highest measured mountain on the face of the globe—and that it is situated some 350 miles nearly due north of Calcutta, and some 50 miles north of the well-known hill station Darjiling. It forms the culminating point of a group which rises on the confines of three countries: Tibet, Nepal, and Sikhim—very misleadingly called Independent Sikhim, since it forms part of our Indian Empire. If you ask me how to spell the mountain's name, I am afraid I cannot give a ready answer. The Indian Government—nay, even the Survey Department—has shown no consistency in the matter. I try to follow the form adopted in the latest official documents, but it is breathless work; they have varied in the last twelve months, and are still inconsistent.

The Kangchenjunga group is completely cut off by the Khosi valley on the west from the mountains of Nepal, and by the Teesta valley on the east from the mountains of Bhotan. In this respect it may be compared to the Bernese Oberland range, which is isolated by the Rhone and the Reuss, and, like the Oberland again, the Kangchenjunga group forms no part of a continental watershed. By crossing the lofty snow-clad spur which unites it to the Tibetan highlands, it is just possible to get round the mountain without trenching on any territory

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THE RHODODENDRONS OF THE ZEMU VALLEY.

officially recognized as Tibetan, though the present political situation in Lhonak, the western headwaters of the Teesta, is very accurately indicated in the following note in the official Roadbook of Sikhim—we now spell Sikhim mostly with an *h*, but on this point again the Indian Government is undecided—published last winter:—

"The whole of the district drained by the Naku Chu and Langpo Chu is called Lhonak, meaning 'the black south,' and is regarded by the Tibetans as their own property, and they very much resent the appearance there of any foreigner."

The Tibetans have been allowed to establish a guard and a wall across the valley containing the eastern sources of the Teesta at Giagong (a desolate spot about the height of Mont Blanc), thus holding the southern approach to the Kongra Lama pass. As in the Alps round Monte Rosa, the northern pastoral race has occupied the pastures at the heads of the southern valleys. It may reassure alarmists to know that here, as in so many other mountainous regions, it is not the passes but the gorges that form the main obstacles to invaders.

Politics, however, are outside our sphere. Nor will I, geographers though we are, spend the evening in deluging you with orographical details. For I am no believer in the system that finds favour in certain quarters—the system of putting the information properly supplied on a map into an interminable series of sentences stuffed with hard names, and calling the mixture, Science.

My object, as I have already said, was to make the tour—the high-level tour—of Kangchenjunga, passing as near the great mountain as might prove to be possible. This had never been accomplished by Europeans. In the map attached to Sir Joseph Hooker's travels in Nepal and Sikhim, published fifty years ago, a broad gap was left to the north-west of Kangchenjunga. Across this blank space was printed the following stimulating sentence:—

"This country is said to present a very elevated, rugged tract of lofty mountains, sparingly snowed, uninhabitable by man or domestic animals."

This gap had been somewhat diminished by the recent wanderings of Mr. White, the Political Agent at the Court of Sikhim, a persevering but too reticent explorer, and of Major O'Connor, who, in 1897 (as the Road-book of Sikhim published last winter informed me on my return from India), penetrated Lhonak, crossed the Chortenima La, a pass at the head of it, and returned through Tibet to Giagong.

On two separate occasions, however, native explorers—pundits employed by the Indian Survey to go where Europeans cannot—claim to have crossed this gap. With regard to the first, the well-known Chandra Das, famous for his adventurous journey to Lhasa, and now a resident at Darjiling, I permit myself to entertain some doubt whether the pass he traversed in 1879, on his way to Tashilumpo,

was identical with the Jonsong La. It is true he says so now, but in his first narrative he called it nothing but the Chatang La, and a pass named Chabok La is shown on maps some distance west of the Jonsong La (*La* means "pass"). Chandra Das's sketch-map is, unfortunately, too vague to be intelligible. But it is to be noted that the late Colonel Tanner, of the Indian Survey, tells us that the Pundit's observations placed his pass considerably west of the Jonsong La. Colonel Tanner concludes that the observations were at fault; but it is at least as plausible that the identification of Chandra Das's pass with the Jonsong La is erroneous. With regard to the second pundit, Rinsing, there is in my mind, despite his odd behaviour when with us, little, if any, doubt that he crossed our pass. This was a most remarkable feat for a native, even for a Bhootia, and Rinsing deserves very great credit for getting his party over with the loss of only two lives, at a late season of the year, what he described, probably with justice, as the loftiest and most difficult pass in this part of the Himalaya. In adopting here the word "difficult," I ought, to prevent misunderstanding, to say at once that I use it in the popular and not in a climber's sense. Some travellers call any path where you cannot ride difficult; in the Alpine Club we restrict the term to places where an active man is in danger of tumbling. There are none such on the Jonsong La, though there is plenty of scrambling over rough ground, and there may be danger at times from falling stones or bad weather. Allowing for the difference of scale in the two ranges, the Alpine pass to which it may most fairly be compared is the well-known Strahleck, between Grindelwald and the Grimsel.

It is to this journey of Rinsing, to which I called attention in the *Alpine Journal* at the time, that, as Colonel Gore tells me, Indian geographers and cartographers have been indebted for such knowledge as they possess of the north-western slope of Kangchenjunga. The information Rinsing brought back was embodied in a sketch-map, a copy of which Colonel Gore has kindly sent me.*

As far as the general trend of the valleys is concerned, Rinsing's work, while not free from error, is in the main fairly satisfactory. He did not carry his map, nor can I carry my commendation much further. Rinsing, by the kind order of his superiors, accompanied us into what, in a memorial he presented to me before we parted, he poetically described as "the jaws of Death." I had therefore full opportunity of observing his method. Sitting in a snug tent and filling in subjective details was much more to his taste than scrambling over rough moraines with a plane-table. As travellers, as observers in the ordinary sense of the word, both he and Chandra Das doubtless deserve our

* This and the other official sheets are in the R.G.S.'s collection, and were exhibited when the paper was read before the Society.

esteem; their narratives are full of local information, and often extremely entertaining. For example, nothing can be more graphic than Chandra Das's descriptions of how he suffered from the rarity of the air, how he was carried uphill on his comrade's back with his eyes shut, how he "embarked on a slide, met with slippery ice, and consequently got pains on the back, caused by friction." But it would, in my opinion, be a mistake to regard them as scientific cartographers in the technical sense of the term.

To get round Kangchenjunga was not the only object I set before me. I hoped also to obtain, what up to the present time the Indian Survey has been too fully engaged elsewhere to give us, some accurate idea of the glacial features of the group, some material for comparing them with those of the Alps and the Caucasus. I hoped to be able to ascertain the number and length of the main ice-streams, the amount of ground covered by snow and ice, and any peculiarities which might distinguish the glaciers from those of more temperate regions.

I am now in a position to give a fairly complete estimate of the glaciers of Kangchenjunga. Four glaciers radiate from the peak, pointing roughly to the north-east, south-east, north-west, and south-west. These are the Zemu Glacier, 18 miles long, and the Talung Glacier, both draining to the Teesta; the Kangchen Glacier, 15 miles long, and Yalung Glacier, both draining to the Arun and the Kosi. The forked spurs that protrude south and west from Kangchenjunga, dominated respectively by Kabru and Jannu, enclose in the first case the Alukthang Glaciers, united not long ago in a single stream, and now divided by little more than their moraines, and the southern glaciers of Kabru, which fall into a separate glen; in the second case, three considerable ice-streams, one of which almost meets the Kangchen Glacier at its lower extremity, the second builds across the valley, out of the rockfalls of the tremendous cliffs of Jannu which encompass its source, a remarkable wall of moraine stuff, similar to those of the Allalein, or the Brenva in the Alps, while a third fills a glen, the stream from which joins the Kangchen torrent at Khunza.

I must not omit, though I was unable personally to explore them, the minor but considerable ice-streams that are seen from Darjiling and Gantok to flow from the southern slopes of Simvoo and Siniolchum or those surrounding the base of Narsing and Pundim, which, in default of any particulars from Mr. White, have been laid down from our sketches and photographs with a certain vagueness.

The ice at the base of the Zemu and Alukthang Glaciers descends to 13,000 feet; this is about its lowest level in Sikhim. Taking into account secondary glaciers, the amount of square miles covered by snow and ice in the group, accepting the 24,340 peak close to the Jonsong La as its northern limit, may be reckoned roughly at 180 square miles.

Next a few words as to the most notable peculiarities of Sikhim

glaciers. To begin at the top, at their sources. We ascertained by means of glasses that the transformation of snow into something like glacier ice takes place within a few hundred feet of the final ridge of Kangchenjunga. *Névé* is found there, as in similar positions on the Jungfrau in the Swiss Alps. In these conditions it may appear strange that we saw or heard so few avalanches. Probably they mostly fall in the heats of summer.

In the upper icefalls the ice is apt to assume strange forms. I may best describe them by comparing them to the earth pillars found in certain friable soils: the glacier is converted, not into Alpine seracs—towers and ridges severed from one another by profound clefts—but into clusters of ice-cones, repeating the same form monotonously. The main glacier is apt to be terribly uneven, a confused labyrinth of huge mounds, stony ridges, and hollows filled with yellow pools, but it is seldom much crevassed. We never had occasion for a rope. Progress is constantly delayed, but seldom stopped. Owing to the steepness of the range, the amount of rock surface exposed, and the rapid disintegration caused by extremes of heat and cold, the trunk ice-streams are buried and hidden under piles of rubbish. Materials enough to build a city are brought down by the gigantic sledge which Nature employs in her mountain architecture. The torrents that flow from these vast glaciers are not, however, in proportion to their size.

The features just enumerated may, I doubt not, find an explanation in the local climate. Intense cold follows on great sun-heat; an enormous deposition of moisture, whether in rain or snow, takes place during many months of the year. Ice under such conditions becomes more plastic or viscous, or whatever term the glacialist of to-day may prefer, it cracks less and is more malleable, it loses more by evaporation. The sun, except in winter, as we learnt to our cost, soon spoils the night's crust that helps the traveller on Alpine snowfields. Rocks, again, are quickly split by alternate heat and frost, and the granite cliffs send down ceaselessly their tribute to the ice-sledge as it glides beneath them. With regard to traces of an ancient extension of the ice, it must be obvious to any trained eye that it has been in recent geological times a good deal lower than it is now. Glacial action may be traced for two or three miles below the present end of the Zemu Glacier. Vegetation and denudation make it difficult to trace it further, but I suspect in some remote age the ice reached Lachen. Throughout Lhonak the surface of the earth shows signs of glacial shrinkage. Lhonak is a region where the conservative action of ice is admirably illustrated in the comparatively shallow valleys and smooth hillsides.*

* I may refer to my paper on "The Conservative Action of Ice" in the *Geographical Proceedings*, vol. x. p. 799. I do so with more confidence since several eminent geologists, among them Prof. Garwood, have expressed their general agreement with my argument.

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KHUNZA IN NEPAL.
Looking North.

As you are probably aware, a European Association has been formed, of which I have the honour to be the member for Great Britain, to carry on the work initiated by the Alpine Club of obtaining measurements, from all parts of the world, of glacial oscillations, which are not without considerable importance as indications of climatic variations. I have reason to hope that our records may be extended to India; but there is difficulty in finding ice-streams near enough to permanent stations to be systematically visited, and there have been in the past artificial difficulties arising from the extreme complexity of the departmental system at Calcutta, difficulties which I think may be overcome by the good-will of the present Viceroy, Lord Curzon, towards all reasonable scientific proposals.

I may be expected to add something to the discussion on mountain sickness that continues, without much sensible advance, to fill pages and even volumes in mountaineering literature. I could easily occupy with it the rest of the evening. For *quot homines, tot sententiæ*. No two persons feel mountain sickness in exactly the same way, though mountain sickness, like sea sickness, is a painful reality to the majority of mankind. My party were affected most unequally; Mr. Dover, the Road Inspector, never appreciably suffered—he even gained weight on our tour; Mr. Garwood was for forty-eight hours practically incapacitated, though sunheat on new snow had probably much to do with his symptoms. Most of us, Englishmen and natives, felt, in various degrees, our powers diminished; we experienced an indisposition to exertion, bodily or mental—what Stevenson, writing of the climate of Davos, calls "an underlying languor of the body"—a slackening of pace and increased breathlessness in going uphill. We suffered most on first reaching an elevation of 15,000 to 16,000 feet; there was no increase in our symptoms on rising over 20,000 feet. Some of our men, particularly the Ghoorkhas, walked steadily at that height. I was myself never so uncomfortable as I once was on Mont Blanc. It used to be said no one could climb the last slopes of Mont Blanc without frequent halts. The last time I climbed the mountain, I walked straight up the last 1500 feet from the Vallot hut. In the Himalaya I was able to walk, at the end of our tour, from 13,000 to 16,000 feet without a halt. We and our Alpine guide were sometimes quite exhausted by the struggle in soft snow; but soft snow is killing anywhere. I have seen Melchior Anderegg, one of the greatest of Alpine guides, dead-beat for the moment, at a height of 6000 feet, by tracking a path over the Great Scheideck in winter. I am ready to commit myself to an opinion. Training and habit and attention to diet will not do away with mountain sickness, but they will go on reducing its area and its virulence. We have practically driven the enemy up 8000 feet in the last fifty years. Our successors will, I believe, drive it up the remaining 5000 feet in the next fifty. Kangchenjunga and its still loftier

Nepalese neighbour will one day have a flag on their summits. This is my prophecy. Let who will contradict it. Time will show.

I turn next to cartography, to the maps that include the Kangchenjunga group. Sir J. Hooker's, the first, is based to a large extent on his own observations. It is in the main a route-map—an admirable route-map indicating the local topography of the parts he visited with approximate accuracy, but, unfortunately, on a very small scale. It does not attempt to grapple with the glacial features of the Kangchenjunga group, which he did not closely explore. Moreover, some of the peaks had not at that time found their true positions.

Next comes what I may call the mother-map—the official transfrontier survey, long labelled "Confidential," on a scale of 2 miles to the inch. On this the great peaks have been placed from distant trigonometrical observations; while a number of the minor summits north of Kangchenjunga appear to have been located and measured by the late Captain Harman and Mr. Robert, who established stations above the lower part of the Lhonak valley. In the portions of Sikhim not penetrated by the survey party, minor spurs and features are indicated with much but often purely conventional detail.* The valleys west of the Kang La are entirely misrepresented on the authority of Mr. Robert (a copy of whose sketch I have before me). He brings the Yalung valley up within a mile and a half of the Kang La! Hooker's little map is far nearer nature here. The rest of the Nepalese slope is left blank. The sole hint of glaciers is contained in the word "moraine" printed across the valley filled by the lower part of the Zemu Glacier.

I desire to guard myself at the outset against any suggestion that in this plain statement of facts I am attacking the Indian Survey. To do so would be a poor return on my part for the aid and courtesy I have received from its present head, Colonel Gore. Moreover, I do not think the facts cited are in any way a discredit to his predecessors. However interesting to the physical geographer, glaciers have no, or at most a very indirect, political, administrative, or commercial importance, and, until a comparatively recent date, they were ignored in most European surveys. The Indian Survey has had its hands constantly full of work urgently needed by the Government, which had to be done first. Nevertheless it has sent surveying parties into the mountains of Kumaon and the Karakoram. The glaciers of Sikhim have so far had to wait. Its tea gardens had a prior claim. Recently, however, there have been attempts to indicate the glaciers round Kangchenjunga on the new editions of official maps.

If you look at these photographs of recent reproductions and reductions of the Transfrontier Map, you will see that the surveyors have

* Sir T. Holdich has informed me that the cartographers were authorized to supply conventional detail where no authentic detail was forthcoming.

been making some endeavour to introduce snow and ice. You may notice a few worms crawling about the heads of valleys. These represent glaciers, to which they bear the same relation that the caterpillars of our school maps do to mountain ranges. They do not exhibit the sources of the ice-streams or their connection with the *névés*, and they stop short miles above the snouts of the existing glaciers. This apparent want of method is, however, I think, not without a purpose. The ordinary conception of a glacier, in the mind of the oriental cartographer, seems to be *bare ice*. The *névé* reservoirs that feed the stream and the moraine-cloaked tongue that descends into the valley are ignored. It is obvious that such representations can be of little value to the physical geographer.*

It has been from time to time the privilege of mountaineers, such as our late colleague on the Council, Mr. John Ball, and Mr. Wm. Mathews, in the Piedmontese Alps, Mr. Adams Reilly in the Pennine Alps, and more recent travellers in the Caucasus, to criticize and make suggestions, or to furnish material, which have led to marked improvements in the Government Surveys of the countries concerned. I should fail in my duty, did I not endeavour humbly to follow in the footsteps of earlier mountaineers, by suggesting by precept, and, as far as my means allow, by example, the principle on which a glacier map of Sikhim, which will be of value to the physical geographer, may be constructed. I therefore venture to offer, by no means as a perfect or a final map (a complex glacial labyrinth like that of Kangchenjunga is not mapped in a month), but as, at least, a specimen of the right method to delineate glaciers,

* The official publications and manuscripts I have had before me are the Transfrontier map (2 miles to inch), 1885; a revision (4 miles to inch), 1889; North-eastern Transfrontier map (8 miles to inch), 1889; Skeleton map of Sikhim (4 miles to inch), three editions, 1892, 1894, 1900; Colonel Tanner's map of Sikhim, 1866; manuscript sketches of Rinsing, 1884–85 (Nepalese slope of Kangchenjunga), and Robert, 1881–83 (district round Kang La). The heights given on these maps appear to be divisible into three classes—

1. Peaks included in the Great Trigonometrical Survey of India, the heights assigned to which have never varied.

2. Lesser summits, particularly those in the chain north of Kangchenjunga, trigonometrically measured by the Sikhim Survey party. Many of these altitudes have been revised, some increased, others diminished, not, Colonel Gore informs me, as the result of fresh observations, but after a recalculation in the office.

3. Miscellaneous heights of passes and places, probably derived from various sources, pundits' or travellers' notes. I give examples of some of the more notable variations: Yumptso La; Transfrontier map, 17,040; Skeleton map, 15,800. Tangchung La; Revised Transfrontier, 17,100; Skeleton map, 1896, 17,840; 1900, 17,340 (misprint?). Thé La; Revised Transfrontier, 17,430; Skeleton, 1892 and 1894, 17,810; ditto, 1900, 16,575. Tobli; Skeleton, 1892, 15,600; ditto, 1900, 14,500. And last our Jonsong La; Sikhim Gazetter, 1894, 22,300; Revised Transfrontier, 22,000; Skeleton map, 1894, 22,000; Colonel Tanner, 1886, 19,000 to 20,000; Rinsing, 21,500. In Mr. Garwood's map I have inserted the official triangulations in thick type, Mr. Garwood's heights in thin sloping type, and a few heights from miscellaneous sources in brackets.

Mr. Garwood's map. I believe it attains to very fair accuracy of detail in the glacier basins, which we ourselves explored in fine weather. Elsewhere it at least indicates approximately the extent of the ground covered by snow and ice. According to my experience, the best spur to further action is to give people something to criticize. This, at any rate, we have done.

Descending below the snow-level and leaving the glaciers, I have still one or two serious, or scientific, matters to which I ought to invite my readers' attention.

There can, I think, be no doubt that the situation of Darjiling is very far from the best possible for a health resort in this region. It was chosen partly at least for political reasons. It stands on the screen of foothills—it is true, on the north or less exposed side of it, having therefore a smaller rainfall than Kursiong, on the south side, but still on the screen that receives the first fury of the rainstorms that sweep up from the Bay of Bengal. This exceptional exposure was demonstrated forcibly in the great storm (of which more hereafter) of September, 1899. The injury done round Darjiling itself was in part caused by the reckless clearing of forest, and consequent exposure of soft slopes at high angles, caused by the spread of tea plantations. But it was the streams fed by the outer foothills, rather than those from the interior ranges, that swept away their bridges and destroyed villages. The observant visitor will hardly fail to notice in the character of the forests a proof that the worst of the rains strike the foothills and surge up the great gap of the Teesta. Farther west, towards and beyond the Nepalese frontier, the vegetation is less rampant; the valleys at the western base of Kangchenjunga are dry and open compared to the glens of the tributaries of the Teesta. The Vale of Kambachen is not more densely wooded than that of Lauterbrunnen, while the Zemu forests are almost impenetrable.

An ideal summer sanatorium would probably be found in the Chumbi valley, which, for reasons best known to politicians, we did not annex fifteen years ago when we had the opportunity of doing so as a penalty for the Tibetan invasion of Sikhim. But, short of this, there are spots—Lachen, for instance, or the downs at the head of the Singalila ridge—where some kind of health station, which would bear to Darjiling—in climate, at least—the relation the Engadine bears to Monte Generoso, may in the future be established. Difficulty of transport will be alleged, but, looking to the development in the last ten years of mountain railways, these difficulties, though actual, will not, I believe, prove permanent ones. This, however, is a matter for the future, perhaps not a very near future. For the present, one of the great wants of Independent Sikhim is horse-roads. In past years pains and money have been expended on patching up the fantastically circuitous and precipitous native tracks which might, I believe, more wisely have been used in

constructing one or two trunk horse-roads, on lines laid down by experts. I understand the authorization of the Government has been given to steps in this direction, and that some steps have already been taken. My companion in Sikhim—Mr. Dover, now the Road Inspector—writes to me of bridges built, bungalows erected or restored, Lachen and Lachung—the villages in the Teesta valley that correspond to Saas and Zermatt—opened to travellers. The Indian Government already publishes a list of tours and resting-places; it has taken, therefore, the initial steps towards creating a mountain playground for Calcutta. A few more efforts in the same direction, and these comparatively slight efforts, might produce great results. Some 8 miles of new path and a couple of bridges would link Pamionchi to Jongri and the southern glaciers of Kangchenjunga, and enable a horse-party to go up this way and return by the Singalila ridge. Some 10 miles of cutting through the forest would open the Zemu Glacier; a stone bungalow on the plan of an Alpine "Clubhut" might easily be built at the Green Lake at the north-eastern base of Kangchenjunga, at a height of 16,000 feet. The tour of Kangchenjunga must, however, I fear, for years to come be a serious matter, apart from political difficulties, since it means coolies, and coolies are—well, they represent time and money. We can hardly ask the Indian Government to imitate the Canadian, and bring out Alpine guides to aid explorers. A climbing party with such aid might, I think, make the tour of Kangchenjunga in a fortnight from Jongri, or even shorter time, could they force the 19,300 feet gap at the eastern base of the mountain. I say nothing here of the ascent of Kangchenjunga. That is an esoteric matter I reserve for the Alpine Club. Nor need I attempt to add anything on the Flora; we have Sir Joseph Hooker's volumes. I have already alluded to the strange imitative forms of the butterflies. Mr. Garwood, regardless of leech-bites, made a large collection of butterflies and beetles; and Signor E. Sella brought home Alpine plants, which he is endeavouring to naturalize at his home in Piedmont.

I will not detain you any longer with general reflections, but attempt to give you a summary of our journey.

My party was composed as follows: Mr. Garwood and myself, Signor Vittorio Sella, the well-known mountain photographer, and his brother. An Alpine guide, A. Maquignaz of Val Tournanche, also came out with us from Europe. The great snowstorm prevented us from making full use of his climbing powers. To this party were further added, by the kind consent of the Indian authorities, Mr. Dover, now Road Inspector in Sikhim, whose services were invaluable; and Rinsing, the native surveyor, I have already mentioned, who made himself very useful in many ways throughout the journey.

Our camp-followers consisted of a horde of coolies, who diminished by dismissal or desertion from about eighty at starting to thirty or

forty at the end. I hope this statement will not make you think we campaigned with heavy stoves and pianofortes. Our tents were 7 feet square, and of the lightest possible make; our cooking-stoves would each have gone inside a silk hat. As it proved, we had only just enough provisions to carry us through the wilderness. A Sikhim coolie's load is half composed of his own rations of rice, hence the necessity of numbers. We had also an escort of half a dozen Sikhim military police with guns and bayonets, who looked after the coolies, and would have protected us from any of the Tibetan robbers who are said to infest the no-man's-land of Lhonak.

After consultation with the few authorities on the matter, I came to the conclusion that my first business was to get our party to a spot reached by Mr. White and Mr. Hofmann, the Calcutta photographer, near the head of the great Zemu Glacier, east of Kangchenjunga. Maps show a gap of 21,000 feet in the range beyond, the chain dividing Sikhim and Nepal, only 4 miles north of the peak of Kangchenjunga. Should this gap prove practicable for coolies, it would save us the circuitous march to the north, necessary in order to reach Rinsing's Jonsong La, which is marked on maps, whether on his authority or Captain Harman's I know not, alternately as 21,500 or 22,000 feet.

Leaving the new Teesta valley horse-track at Lachen (8800 feet), a village the inhabitants of which are Tibetan in type and manners, we hacked our way, by the aid of our Ghoorkha pioneers, through the rhododendron forests of the glen that checked Sir J. Hooker, and in five days—after the track had been opened it proved a two days' walk for a messenger—we reached a wild goats' pasture and a small green tarn at a height of over 15,000 feet, some 10 miles above the foot of the glacier and within four hours' walk of the extreme source of the ice under the gigantic cliffs of Kangchenjunga. There we established a light camp, leaving our heavier tent and the bulk of our followers some miles lower down.

Next day, full of hope, and in apparently improving weather, I set out with our Alpine guide to reconnoitre. We found our way over rough ice and rugged but flowery hillsides to the very base of the Kangchenjunga precipices. I was within at most, I think, three hours' easy walk of the 19,300-feet gap (it might properly be called the Zemu gap), which, however formidable from the south, is perfectly easy of access from this side. I resolved to move our camp up to the last *terra firma* where there was enough juniper for a night or two's fires. Thence we could, I believe, in the existing conditions, easily have climbed Simvoo, officially known as Siimvovonchim (22,300 feet), and got a full view of the east side of our proposed pass to Nepal, the crest of which we had already seen in profile against the sky from the lower glacier. It lies at the head of a large tributary glacier flowing from the west-north-west, which we had crossed half an hour above our camp. *L'homme*

propose; the demons of Kangchenjunga disposed. The sky, which had been deep blue, turned pale, then grey, then almost yellow; thin, ugly vapours gathered upon the great crest. The sun grew sickly, and was surrounded by a lurid ring, coloured from time to time by strange iridescences. The air was perfectly still and very close and warm. Recognizing all, and more than all, the usual signs of bad weather, we hastened to return to camp. When halfway we saw dark mists racing up the valley, and were met by a keen blast. We raced too, and got off the moraine as the first flakes of snow fell. In a few moments the storm was on us, everything was blotted out, and we were guided into camp by the shouts of our Darjiling Sirdar, who had hurried out in search of us. I tumbled into my tent and panted speechlessly for some minutes. I had forgotten that it is inexpedient to run a quarter of a mile, even downhill, when at the level of the top of Mont Blanc.

The history of the next twenty-four hours was a blank—a white page in our diaries. The snow fell heavily all Saturday night and Sunday. In the evening some coolies came up from our lower camp and told us that four men we had sent down the evening before had not turned up, and must be lost. The Sellas proposed that a relief party should set out at once in the darkness. I discouraged such action, feeling convinced that the men, following the fashion of the country, had taken shelter under rocks. I proved to be right.

At dawn on Monday it was, after forty-two hours' fall, snowing as hard as ever. We measured exactly a metre (3 feet 3 inches) round our camp where it had not drifted. The snow had to be cleared off our tent-roofs every half-hour to prevent a collapse. There seemed no reason why the storm should stop, and every reason that we should go. One of the smaller tents was completely buried, and the few coolies with us were naturally frightened and impatient. Even our Alpine guide began to babble of avalanches.

We shall none of us forget that walk to the base camp. We started in a dense fog. At first the snow was so deep that it seemed hardly possible to move more than a few yards. Unladen men went ahead to beat a track; we and the light luggage followed. The work was very laborious, and our progress of the slowest. Sending constantly a fresh man to the front, we floundered along, sinking deeply at every step, and glad when we did not tumble up to our waists in some hidden pitfall. Of a sudden the veil was rent before our eyes, and, incredibly vast and strangely transfigured, white and shining from base to summit, the giants of the Himalaya looked down on the train of miserable ants crawling about their feet. The hot glare reflected from the snow and enhanced by the shining particles of mist was terrific; our faces were scorched, and my lips so badly blistered that, as they were subsequently touched by frost, it was six weeks

before I could eat a meal in comfort. This was a unique experience. We never suffered again from heat or sunburn during our tour.

It was not till long afterwards that we learnt that this calamitous storm, which changed the character if it failed to defeat the main purpose of our journey, was no ordinary incident of Himalayan travel, but the phenomenal outburst which, by the havoc it wrought in and about Darjiling, acquired a world-wide notoriety. Nor, happily, were we aware that some newsmonger at Darjiling had excited our friends in England, by reporting by telegram that there was every reason to believe that we were buried under avalanches which from a distance of 40 miles he had watched falling on the southern face of Kangchenjunga, the opposite face to that on which we were! The modern news-sheet, which makes "the moving accident its trade," is a pest to travellers, except, perhaps, those who travel to be boomed.

Next morning we woke to "set fair." The world was all white; the smoke of our camp-fires alone sullied the blue heavens. The fine weather which, with one break of forty-eight hours, was to last for the remainder of our journey had set in.

But the conditions were altogether changed. The Easy had become Difficult; the snow-level had been lowered 4000 feet. We had hoped to make some high ascent, to force a pass into Nepal from the head of the Zemu Glacier. All such projects had now to be abandoned; to get round Kangchenjunga somehow was all we could hope, or reasonably attempt. Our plan had to be modified to suit the altered conditions—to speak more exactly, the lowered snow-level—which we were henceforth to find at 14,000 to 15,000, instead of 18,000 to 19,000 feet. My companions spent two days in plane-tabling and photographing on the Zemu Glacier. We gazed with ceaseless delight on the peak immediately opposite our camp—Siniolchum, 22,750 feet—the most beautiful snow mountain I have ever seen, perhaps the most beautiful in the world. Its icy sides are exquisitely fluted by avalanches; the snow upon its edges is blown up into fantastic fringes, so thin as to be transparent to the Indian sunshine.

Siniolchum stands with reference to Kangchenjunga and the Zemu Glacier much as the Aletschhorn does to the Jungfrau and the Aletsch Glacier, that is, on the flank of the lower part of the glacier, while Kangchenjunga rises above its head. On the fourth day after the storm we started to cross two passes, the Thangchung La and the Thé La, over which runs a native yak-track, used for the transport of timber and salt between Tibet and Sikhim. In an ordinary year these passes are as easy and not more laborious than the Wengern Alp and Great Scheideck in summer. They now exactly resembled those passes as I once found them in January—that is, they were snow-grinds. The loose snow on the descent was very trying to the coolies, who made many involuntary glissades. Preferring to black their faces, or, in the case of the Lepchas,

to improvise veils with their long locks, rather than to use the spectacles with which I had provided them, they suffered also from snow-blindness.

In three days we reached the lower end of Lhonak, and in two more its head. This district, though on the Indian side of the watershed—in fact, feeding the main source of the Teesta—displays all the characteristics of Tibetan landscape. The shapes of the hills and the foreground are those of an ice-modelled region, like the duller parts of the Highlands. The 21,000 to 24,000 feet peaks which overlook the valley are on much the same scale as those of the Upper Engadine; they rise from 5000 to 7000 feet above their bases. Huge moraines mark the former extent and limits of vanished or diminished glaciers. There is not a tree to be seen; even the grass is scanty; the slopes are brown and yellow, the flats grey and sandy, and strewn with sky-reflecting pools, or flecked with patches of light-blue gentians. The only signs of human habitation from one end of the region to the other are two or three low walls which afford summer shelter to a few Tibetan shepherds and their yaks. We saw nothing of the shepherd-robbers, who, according to Chandra Das, "have charge of the passes," and in return for their services, are authorized to rob all travellers who venture to cross them. If they still exist, they had all gone north to their homes; but we met and slew a lonely yak. How it came to be there was a mystery. Some said it had been left as a peace-offering to the mountain demons, a scapeyak; others, that it had been driven out of the herd by a stronger bull—a broken horn gave some countenance to the latter hypothesis.

From the head of the valley I and Erminio Sella, led by Rinsing, climbed to a ridge which Rinsing declared to be the Chortenima La. It was not that pass, which, as we subsequently ascertained, lies farther west, but part of a glacier-clad range dividing us from another source of the Teesta. The gap, which we reached by a rough scramble, was between 18,000 and 19,000 feet in height, and commanded a superb view, of which my companion obtained panoramic photographs. Southwards, over a wilderness of fresh snow, we saw the Kangchenjunga group, and our eyes, ranging through west and north to north-east, followed the chain that connects it with the Tibetan plateau. Above the Lhonak glaciers the granite apparently trends away westwards; the range north of Lhonak is limestone.

Three gaps in the ridge encompassing the head of the Lhonak valley were conspicuous. That on our left, between the peaks marked 24,340 and 22,700 feet on official maps, was obviously, though long and lofty, under ordinary conditions free from anything a mountaineer calls difficulty. A steep, but not excessively steep, snow-screen connected the two peaks, while the hollow beneath was filled by smooth glaciers. The ground below the ice is usually bare broken slopes; it was now one vast sheet of snow spread over long hillsides.

To accomplish this most laborious ascent, we took, or rather our coolies took, two and a half days. The distance was considerable, but the actual height to be climbed not over 5000 feet.

Our difficulty was entirely caused by the fresh snow. We waded and floundered through the hours of light with much waste of precious time at the beginning of each day, the result of the incorrigible habit of the coolies of waiting till the sun strikes their tents before they will uncurl and cook their indispensable morning meal.

In this way they lost, of course, any chance of finding the snow hard. The worst part of the climb was the lowest, where we tumbled about among the hidden pitfalls of loose moraines, or waded up a little stream, which we found preferable to wading in the deep snow on its banks. As we mounted, the views grew wider and more majestic: we gazed out to Chomiomo and Chumalari, and on a range of unknown peaks between and beyond them. We enjoyed superb sunsets and mystical afterglows, the brilliant colouring of which was enhanced by contrast with the white fields of snow which encompassed us on every side. The final ascent to the pass gave us no particular trouble; the last climb was up a bank of bare loose rock. The actual crest proved a cornice, overhanging an incipient crevasse. We broke a hole through the snow-wave and stood on the top, for which our measurement gives the height of 20,200 feet.

Our first feeling was one of disappointment. Rinsing had been promising us a view over Nepal and the valley of the Arun to "Mount Everest." A ridge a mile off, very little higher than our pass, shut out that view. Our next feeling was dismay, when Rinsing, a comical figure, burnt red as a turkey-cock, and shaking his pigtail mournfully, announced that we were not on the right pass. I admonished him sternly to keep his opinion to himself, for if our coolies once heard it, how should we induce them to persevere?

What we saw was a broad névé basin some 500 feet below us, from which a glacier stretched away down a narrowing trench between rocky walls until it was closed, apparently hermetically sealed, by the huge bulk of Kangchenjunga. To the right, the blunt head of Jannu, oddly like that of the Matterhorn from Breil, rose for the first time over the nearer icy ridges.

From what I had seen three days before, I felt certain that the basin below us did not drain into the Teesta as Rinsing now asserted. Our plane-table, directed on Kanchenjunga and the great peaks, showed that we were approximately in the position assigned to the Jonsong La on the map. After some discussion, we determined to go on; but the lingering of the coolies forced us to camp on the ice again before we had got far. The next day we rambled over the frozen hillocks and down the sloppy dales of the glacier. The afternoon we spent in traversing a rocky slope, in the gullies of which stones rattled dangerously at intervals. We slept

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KANBACHEN IN NEPAL.

another night, our fifth, on the ice, for on its banks there was nowhere to pitch a tent. Tributaries poured in on all sides their broad billowy icefalls. Kangchenjunga rose up ever nearer and nobler in front. At last, where our glacier plunged down to the meeting-place of ice-rivers under the craggy buttresses of the great mountain, Rinsing, with unexpected confidence, struck up a steep moraine on our right. In a quarter of an hour we were on turf, a pleasant terrace sloping down parallel to and far above the ice. Just at the corner over the junction of five glaciers whose united flood flowed west, or at right angles to our previous course, we pitched our tents on a platform where the snow lay only in patches, and there was dwarf juniper for firewood. Our coolies shouted for joy as they threw off their burdens on the dry turf.

We were safe in Nepal, at the head of the valley of the Kangchen, looking at a sight never before seen by European eyes—the north-western face of Kangchenjunga, not a sheer cliff, like the three other aspects of the peak, but a superb pile of rock buttresses, terraces of snow, and staircases of ice, through whose labyrinthine complexities the future conquerors of the great mountain will have to find the least hazardous way to the summit.

The best part of the next day we waited for stragglers, and gazed at the stupendous scenery. Some of our coolies were still lingering in the rear, and did not catch us up for forty-eight hours, when they reported that they had lost one of their number, who had preferred to remain behind and die to walking any further. We could not make them share, or even understand, our horror at their desertion of their comrade. They simply said, "He did not wish to live; he had a right to do as he pleased." They were, of course, Buddhists.

Many of the coolies were a good deal the worse for the snow; there were among them several slight cases of frostbite and of sore eyes; for to make them use the boots and spectacles provided was a hard matter. But there were no very bad cases, and when Mr. Dover met some of our men twelve months afterwards, they expressed their readiness to go again. I ought, perhaps, to mention that they were volunteers.

We had still two days' march, of which we made three, in order to reach Hooker's old tracks. But it was all downhill. For several hours we trod on meadows of edelweiss beside the huge boulder-burdened glacier. Long green alleys beside the glaciers are a feature of Sikhim, and a great convenience to travellers. Possibly they are preserved by torrents issuing from side glens, which by constantly washing away the lateral moraines restrain the main glaciers from pressing the hillsides. We passed a gap on our right, which presumably leads up to the Chabok La. Here were some at the time deserted shepherds' huts, the first human dwellings we had seen since leaving Lachen twenty-one days before. On our left a fine glacier came straight down from the westernmost of the five peaks of Kangchenjunga, and almost joined that we

had descended. It issued from between two icy ridges. I never saw such perpendicular mountain architecture as that of the spur that overhangs the valley on the left at this point. Kambachen is a group of stone huts, such as may be seen anywhere in the Italian Alps, but is rendered picturesque by numerous chortens and prayer-flags. It was deserted when we passed. It lies immediately under Jannu, which presented its astounding precipices in the morning light.

The next reach of the valley is very beautiful. Forest begins below the Jannu Glacier, a forest of junipers, firs, and some deciduous trees. High cliffs rise on either hand, and the snow-peaks peer above them. But that the walls are granite, not limestone, the scenery might be compared with that of the Lauterbrunnen valley.

At Khunza, a large and populous village and monastery, we came on human beings, and met Sir J. Hooker's track. Considering that only one Englishman had ever visited Khunza, and that half a century before, we excited very little curiosity. The people cross to Darjiling to sell butterflies, so that Europeans were no novelty to them. They seemed well-to-do; large herds of yak, said to be "State property," were pasturing on the meadows, and poultry and potatoes were fairly abundant.* Their cottages were wood-built in the Swiss style.

We next traversed three passes of about 15,000 feet, on the spur of Jannu, described by Hooker as the Choonjerma. From one of these we had a noble view on one side over Nepal; on the other, of Jannu and its satellites. The blue vault was ringed with wintry snows; round us the upper slopes and valleys were rich in the faded reds and browns of autumn; below these spread the eternal green of the zone of tropical summer; and beyond, again, we could see the pale shimmer of the plains of Bengal. But the centre of the scene (to us at any rate) was the Lapchikang group, with the highest measured peak in the world, the Mount Everest of the survey, the Chomokankar of Major Waddell and the Pundits,† rising behind the splendid dome of Makalu. Owing to our being so far north, it appeared on the northern instead of the southern flank of Makalu, where it is seen from stations on the Singalila ridge. Rinsing consequently could not recognize it! In shape it is not imposing; it looks an "easy mountain." Its outline reminded me of that of the Dôme and Aiguille du Goûter, Mont Blanc being suppressed. Behind it rose a gigantic rock-peak which is invisible from more southern stations. I regret that I cannot throw any fresh light on the question whether there are—as several native explorers and Mr. Graham have suggested—higher summits north of Everest. We did not recognize

* See 'Narrative of a Journey to Lhasa,' by Sarat Chandra Das (Calcutta, 1885), for a detailed description of Khunza.

† See Major Waddell's very instructive and entertaining volume, 'Among the Himalayas' (London, 1899).

any, but we were 3000 feet lower than the Kang La peak, whence Mr. Graham thought he saw them.

From this point we diverged again from Sir J. Hooker's track. Clouds and a snowfall, coupled with failing provisions, prevented any exploration of the glaciers between Junnoo and Kabru, and hindered us from climbing the Kang La peak while crossing the pass of the same name.

We arrived at Jongri (13,100 feet), a yak pasturage with two stone huts, the future Riffel Alp of Sikhim, in driving sleet. Despite broken bridges, Mr. Earle's kindness had sent up our letters and fresh stores by the Singalila route. The fine weather soon returned, but it became much colder. The smaller streams, down to 12,000 feet, remained frozen all day. We climbed Kabur, the local Riffelhorn, 100 feet higher than Mont Blanc. I believe that had we gone first to Jongri, and not encountered the great snowstorm, we might have got up Kabru. It is obviously the most accessible of the great peaks. We tramped north, a three days' march there and back, to the Giucha La, a 16,400-feet pass under Pandim, which has been visited by a certain number of tourists from Darjiling.

We enjoyed sunrises and sunsets, the rose of dawn on Kangchenjunga, the last flush of evening on Kabru, radiant noons and still more rare and radiant full moons; we watched the clouds rising in pillars, like our childhood's friends the genii of the 'Arabian Nights,' from the depths of the valleys; beyond the varied greens of the forest foreground we saw the marvellous sapphire waves of the distant foothills; we recognized in the golden haze of the far-away plains the windings of the silver ribbon of the Teesta, 80 miles off.

At last we turned our backs on the snows. We plunged down 6000 feet in a few hours, through a wild tangle of rhododendrons and bamboos; we spent a long afternoon in tripping delicately across the face of cliffs on frail and ruinous bamboo balconies, or climbing up and down rock staircases and ladders of roots. Such is an aboriginal path, neither difficult nor dangerous in the climber's sense of those words, but singularly vexatious to a weary traveller.* We accomplished a two days' journey in one, and, in the gloaming, we emerged from the forest, and, leaving behind us the screeches of the green parrots and the chatter of the monkeys, who had seemed to mock our slow steps, we were greeted by a band of yellow-coated Buddhist lamas from the Dubdi monastery, the oldest in Sikhim, who played us into camp at Yoksun with fifes and drums, horns and clashing cymbals.

We had returned to the land of men, of temples and villages. Our march became a progress. At every few miles we found a roadside arbour garlanded with yellow flowers, a table spread with bananas and oranges, and bamboo mugs full of murwa, or native beer.

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* Mr. White, however, lost a coolie in one of the torrents that cross the track.

At the monastery of Pamionchi, perched on an exquisite hilltop (6600 feet) in a natural park, a devil-dance was performed in our honour —for a handsome fee—by a party of young lamas who were going up to Alukthang to offer a week's service to the demon of Kangchenjunga.

On the fifth day from Jongri, including one of rest at Pamionchi, we regained Darjiling; we exchanged narrow tents or dak bungalows, in which the rain came through the roof, and our feet went through the rotten floor, for European houses. In short, we returned to civilization.

Our journey had occupied in all seven weeks, during which we had ascended and descended some 75,000 feet, or 14 vertical miles up and as many down. We were twenty-four days between Lachen and Khunza without meeting inhabitants, twenty days without seeing trees. Except for a few contributions from our sportsmen, we were during this time wholly dependent on the provisions we carried with us.

I should like my concluding words to be of very sincere thanks to the Indian authorities, who, from his Excellency the Viceroy downwards, in the most generous and sympathetic spirit, did everything in their power to help us in our novel enterprise; and more especially to Captain Le Mesurier, the acting Political Officer in Sikhim, and his wife, who came with us as far as Lachen, and blocked the retreat of our coolies; to Mr. Dover, our most able and energetic and cheerful companion, who ruled the camp with gentle firmness; and to Mr. Earle, the Assistant Commissioner at Darjiling, who sent relief parties to meet us on our return march.

Before the reading of the paper, the PRESIDENT said: We have to offer our thanks to the Board of Works for the new electrical installation which has been put up entirely for our benefit, and which I believe will be used the first time this evening, when we welcome amongst us our very good friend Mr. Freshfield. You all remember what excellent papers he has given on the Caucasus, and now he is about to describe to us his very remarkable journey round the great mountain mass of Kanchenjunga. I will now call upon Mr. Freshfield to give us his paper.

After the reading of the paper, the following discussion took place:—

Sir THOMAS HOLDICH: I should like, if it won't detain you too long, just to make one or two remarks about the map which you have in your hands to-night. It is an interesting map, because it represents somewhat a new departure in mapping. You will, at any rate, agree that it is a very vast improvement on its predecessors. Now, Mr. Freshfield has referred to the manner in which the previous maps were made. Any map, made as they were from a distance, must necessarily depend on what we may consider as conjectural topography, particularly as regards glaciers and ice-fields. It will be, as a matter of fact, more or less a fancy map. Now the question is—and I think it is a question which really deserves deep consideration by this Society—whether this new system of making maps by the conjunction of photography and topography, which they now call photo-topography, can ever lift our maps entirely from all regions of fancy on to a solid basis of topographical fact. For my part I am rather inclined to doubt it. The only people that I know who have satisfactorily exploited this system

V. Sella, Photo.

Dr. BLANFORD: I certainly have some knowledge of Sikhim, but I have never been in that part north and west of Kanchenjunga of which Mr. Freshfield has been talking this evening. In the first place, I have to congratulate Mr. Freshfield on having accomplished a task that has long been very much desired, and I think in addition to this he has done important service to geography in several ways. There are many of us who look upon the view of Kanchenjunga from Darjiling as one of the views of the world. It is very satisfactory to hear from a traveller who has had so wide an experience as Mr. Freshfield, that he agrees in this opinion. I think the upper valley of the Lachung, which is the valley to the east, is more beautiful than the Lachen valley. The Lachen valley, when I passed through it, was singularly inaccessible. Here and there on the route it was necessary to traverse difficult places like that of which an example was shown on the screen in one of the photographs. The Lachung valley was more accessible, and it is interesting on account of the enormous moraines by which it is crossed, and which are the remains of former glaciers. Mr. Freshfield spoke of there being a moraine just over 8000 feet above the sea. This is below Lachen, and there is a specially large moraine in the other valley, and that can scarcely be more than 7000 feet above the sea. The shape of the valley below Lachung is such that it is very probable the glacier came farther down, and this leads me to a point that has been remarked upon by both travellers, and especially by Mr. Garwood, the peculiar form of the Sikhim valleys. I was some time ago talking with a very experienced European geographer and geologist about the remarkable shape of the Himalayan valleys, and I told him it was my impression that people whose experience is confined to Europe may never have seen a valley shaped by pure fresh-water denudation-rain and river. The larger valleys in mountainous parts of Northern and Central Europe have almost always been partly moulded by ice. But, although the glaciers in Upper Sikhim undoubtedly came down in places to about 7000 feet, there are no glacial markings in Lower Sikhim. The whole of the denudation is pure fresh-water denudation, and this is of great antiquity, for, although the evidence has not been found in the Eastern Himalayas, in the Western Himalayas there is clear proof that the valleys which now cut their way out of the mountains were cutting their way out long before the glacial period, in Pliocene and perhaps even in Miocene days. I will not detain you any longer; I can only congratulate Mr. Freshfield and Prof. Garwood on the results of their journey, and on the very beautiful examples they have brought back with them.

Mr. FRESHFIELD: I have only a few words to say with regard to the various remarks made by speakers. With regard to Sir Thomas Holdich's remarks, I entirely agree that the work of a trained staff of surveyors is the best thing you can have. But how many years will it be before the Himalayas can be surveyed in that way? In the mean time, need we be content with the "conjectural topography" of the existing Survey maps, or may we endeavour to supplement it by means of the camera and plane-table, in the use of both of which my companion, Mr. Garwood, had had previous practice? With regard to what Mr. Paul said of Rinsing, I did not quote him as in any way responsible for our map produced to-night, nor did he furnish me with the material used in its construction,* though he was most useful to us as a local guide and in many other ways. I quoted Rinsing as the sole cartographic authority Colonel Gore, the present Surveyor-General, could refer me to for the Nepalese valleys west of Kangchenjunga,

* With one exception, the central portion of the Talung Glacier, for which he is mainly responsible. For further details. see the note which will accompany Prof. Garwood's map.

and I exhibit to-night in the tea-room the manuscript map of those valleys made by Rinsing on his previous journey, and kindly sent me by Colonel Gore. With regard to the sites of sanatoria which may in the future supplement or rival Darjiling, bearing to it a relation similar to that of the Engadine to Monte Generoso, I think any detailed discussion would be at present premature. I regard this as a question of the future; its solution depends chiefly on the construction of light mountain railways similar to those which are being constructed everywhere in the Swiss Alps. Mr. Blanford's praise of the scenery of the Lachung valley I entirely endorse. I was fortunate enough to walk up the lower portion of it, nearly as far as the chief village.

The PRESIDENT: It remains for us to thank Mr. Freshfield for his paper. He has led us into a most important and most interesting geographical subject. One's mind goes back to the time when those great peaks were first measured, fifty years ago, when the Himalayan series—I believe the longest between two measured bases that ever was taken—when that series was measured along the foot of the Terai, in so noxious a climate that over forty or fifty of the native surveyors and three officers died, and I believe that party had to be renewed more than twice. It was under such tremendous difficulties that seventy of those peaks were first measured. A long period has elapsed since then, and it has not been possible, owing to the pressure of work in other parts of India—and most marvellous work it is, that work of the Indian Survey—owing to political difficulties, and still more owing to financial difficulties, for surveyors to reach the bases of those peaks, or the greater part of them; and their glaciers have not been explored. It is a matter for the future. This is one of those great regions of the Earth which are unknown and unexplored, and we look forward to the extension of our knowledge there at some future time. But there can be no question with us to-night that Mr. Freshfield has made a most remarkable commencement of that exploration by his journey to Kanchenjunga. We have to thank him for a most interesting paper, which included that very eloquent description of the beauty of the scenery passing through the valleys to the higher land at the foot of the ice, and we have to thank him for the marvellous series of photographs which have brought still more clearly to our minds the beautiful description which he gave of that scenery. We also have to thank Mr. Garwood for his interesting remarks on some of the physical features of the country, especially respecting the hanging valleys. I would ask you, therefore, to pass a very cordial vote of thanks to Mr. Freshfield for his paper, and to Mr. Garwood for his address, and for the very beautiful series of photographs, taken by Signor Sella and Mr. Garwood, that Mr. Freshfield has shown to-night.

THE RUSSIAN POLAR EXPEDITION IN THE "SARYA."

By Baron ED. VON TOLL.

LEAVING St. Petersburg on June 21, 1900, the *Sarya* first touched at Kronstadt and Revel. At the latter port, on June 26, I quitted the ship to go by way of Helsingfors, Stockholm, and Christiania, to Bergen, whither, under command of Lieut. Kolomeitzov, the ship steered a straight course. At Christiania I was indebted to Prof. Nansen for many valuable advices and suggestions. On July 3 I caught up the *Sarya* at Bergen. Here from different towns were

collected the instruments and articles of outfit destined for the expedition. On July 7 I gave orders to weigh anchor, and, passing by the rock-strewn coasts of Norway, we put in at Tromsö. Leaving this place on the 21st, we doubled the North cape on the 23rd, and with a favourable wind made, at a speed of 7 knots an hour, for the Murman coast. On the 27th we entered the harbour of Alexandrovsk, on the Murman coast. Here there awaited me the non-commissioned officer of the Yakutsk Cossack regiment, Rostorguev, my trusty companion through the expedition of 1893, and Striskev, a citizen of Ustyansk, with twenty East-Siberian draught-dogs, which, unwearied by the nearly 8000 miles (12,000 versts) they had already covered, were in excellent condition. Here, besides, I received forty Ostyak dogs, brought to me by A. Trontheim from West Siberia.

In respect of the schooner chartered by the Governor of Archangel to carry a cargo of coals provided by the Ministry of Naval Affairs from Archangel to Yugorski Shar, I heard in Alexandrovsk the unwelcome intelligence that, in attempting in the middle of July to reach Waigats, she was so damaged by the ice as to have to return to Archangel. The damage, however, could not have been so serious, seeing that, by direction of Herr von Engelhardt, the schooner was to set out anew on August 2 for its place of destination, Cape Grebeni. When, on July 31, the *Sarya* cleared the harbour of Alexandrovsk, I might, under favourable circumstances, hope to meet the schooner at Cape Grebeni. On August 3, near by the island of Kolguev, we encountered a stiff contrary wind, so that under full steam the progress of the *Sarya* was reduced to two knots. It therefore became apparent to me that the sailing schooner would reach the cape so very much later than I, that, unless at a fatal cost of time, it would not be possible for me to await its arrival there. In this way we found ourselves denied the opportunity of renewing the supply of 300 tons of coal we had shipped on steering out of Alexandrovsk, before making our entry into the Polar sea. On August 7, finding an ice-clear opening into the Yugorski Shar, I took advantage of the favourable moment, and the same day attempted the passage into the Kara sea.

Without halting at the village Nikolskoye, we steamed under a light S.W. wind through the Yugorski Shar, and at eight in the evening of the same day we were in the Kara sea. Till midnight we were able to hold on our north-easterly course, meeting till then open waterway and only here and there broken ice. On the morning, however, of August 8 we were forced to abandon this course, entering, as we did, fields of ice. Skirting their edge, we had to penetrate, in a south-easterly course, deeper into the bosom of the Kara sea. For some 70 nautical miles we held on to the south-east, often beating about in fog between drift-ice. On August 8 the first hydro-zoological station was set up in the Kara sea — the seventh from Alexandrovsk. On August 9 we came on so much

ice-free water between the fields of ice that, sailing by the boundary-line of the ice-fields between light drift-ice, we were able to resume a north-north-easterly course. From August 11 onwards, we remarked the influence of the warmer water of the Obi. The navigable way was freer from ice, and grew freer still the nearer we approached the mouth of the Yenisei. On the afternoon of August 12 we sighted the island of Kuskin, on the east side of which, under 73° 30′ N. lat. and 80° 55′ E. long., lies Dickson harbour, the name given it by Nordenskiöld. Here, for the sake of cleaning our boiler, a measure necessary to take in hand before launching into the region of the unknown, we made a halt of six days. By way of scientific utilization of this detention, we did our best to explore the region in all directions.

On the afternoon of August 18 we steamed out of Dickson harbour. Steering 30 nautical miles to the north-east, we struck on ice, which, however, did not hinder our progress. Next morning we sighted an island, which, both from the map and from Nansen's drawing, I was able to identify with the largest and the southernmost of the Kamennye islands. This was the last time throughout the whole passage, on to as far as our winter haven, that we were able to orientate our situation according to existing maps. Here, then, was the beginning for us of a trying time, seeing that not one line of the mapped coast, not so much as one of the many islands, answered in its situation and form to the facts presented to our eyes. We had, moreover, continuous fog and much drift-ice, compelling us frequently to veer round into even a southerly course. The further progress we made in the region of the rock-strewn Taimyr bay the more difficult became our course. The fog being thicker by night than by day, I had the *Sarya* moored by night to floes or cast anchor, for fear of being carried farther out of our way in the fog. Thus on the night of August 19–20 we lay moored close by a cape or island to the north-east of the mouth of the Pyasina, while on the night of August 21 we lay anchored near an island belonging, perhaps, to the group of the Scott-Hansen islands.

Hitherto I had been lucky in finding navigable water outside the rocks. Now, however, I was forced by the ice to sail between the rocks and the continent. In this course we soon got into a labyrinth, of the beginning of which we were warned by striking on a stone, to clear ourselves from which took us three hours' work with the kedge-anchor, and the reversed engines all the time put at full steam. The next day we discovered a deep bay, parted into many lateral arms, which I propose calling Minin bay, from Lieut. Minin. On August 26 we doubled a cape, perhaps Cape Sterlegov, after which we shot into good navigable water, in which we made fair speed. Next morning, however, the way was barred by thick drift-ice and fields of ice. Only to the east was there an open road cutting deep into the land. As in the last few days topographical determinations had become impossible from the

clouded state of the skies, while the reckoning of our course suggested the possibility of our having reached the entrance into the Taimyr sound, I resolved to turn into the channel to have this question settled, and to await a favourable change in the conditions of the ice. After we had taken shelter in the sound in question, the sky still refused to yield us any determination of our situation. A sounding taken by Lieut. Kolchak on the steam-cutter showed that the depth declined in an eastward direction. Yet whether we should find a passage open for us or should be running into a fjord, was a question not to be decided in the thick fog. On August 28 I therefore made the attempt to circumnavigate the field of ice which, outside this questionable route, had fixed itself in a direction from south-east to north-west, in front of the mouth of the channel. After steaming 30 miles westwards, along the edge of the ice-field, without reaching the end of it or discovering any opening in the ice through which we might recover our course, I resolved to turn about and again seek the shelter of the dubious channel, in order to there await the disruption of the ice-masses, to settle the problem whether the channel in front of us were a sound or a fjord, and in any case to look out a site suitable for us as a winter haven. The channel in question was not long in discovering itself to be a fjord-like bay, cutting deep into the land. Here we passed nineteen days, from August 28 till September 16.

The labours carried out in this interval enabled us to determine that this channel was the first one on the coast of the western Taimyr peninsula, in which many scientific investigations have been made and geographical determinations of place instituted. In memory of Alexander von Middendorf, the first explorer of the Taimyr land, I should, therefore, like to have it named Middendorf fjord. In order to observe the movements of the ice in the sea, and not to lose any chance of navigable water that might offer itself, I had the anchor cast first near by the mouth of the fjord. A strong movement, however, of masses of ice, drifting in from the sea, compelled me to seek more protected anchorage deeper in the interior of the fjord. In a north-western bight of the fjord there was found a harbour very well qualified for winter quarters. In honour of the last fellow-leader of Middendorf, the founder of the climatology of Russia, K. S. Wesselovski, I should be disposed to call this harbour Wesselovski harbour. Though there was here plenty of driftwood to serve us in the way of fuel through the winter, and though in Wesselovski harbour we should have been safe from all pressure of winter ice, yet I could not reconcile my mind with the idea of wintering here. Apart from the dangerous road in this fjord, I was afraid of the possibility of not finding next summer a free passage out into the sea. Already, during our stay, the entrance by which we had sailed in was blocked with thick drift-ice. Another outlet out of the Middendorf fjord was still open, the more

southern of the two, but, to judge by the many drift-ice floes there lying on the ground, it seemed to be much shallower than the arm by which we had sailed in. I commissioned Lieut. Kolomeitzov to take soundings of this water, and it was found, in fact, that, taking all due precautions, a through passage might be effected. On September 16 we happily cleared the Middendorf fjord. The masses of ice had, however, parted only a little, just enabling us to get round the next islands, sailing as we did through the ice-holes. Soon, however, fields of ice again lay spread out before us, compelling us to put back to the first island of that group. On September 18 I again attempted to penetrate further to the north, and, were no better course open, to sail round the west side of the group of islands named by Nansen the Nordenskiöld islands. The result was not more favourable. Towards the north we again encountered unbroken ice. After the *Sarya* had been moored, on the night of September 19, to a drifting ice-floe, and the dawning day brought no improvement in the situation, I had the ship turned shorewards. Here we discovered a new bay, named by me Kolomeitzov bay, which, in case of necessity, would have served as a good winter haven. In the hope of a north wind springing up, such as could alone part the ice, we waited till September 22. What was hoped for came to pass, so that on the 22nd, under full steam, the *Sarya* again made a forward movement—but not for long. We made but a few miles, when the ice forced us to put in at the next bay. Here, from a mountain, I at last caught sight of the Taimyr sound, from which, however, ice-masses still barred our way. In this bay we waited till September 25, on the morning of which day, from my mountain-top, I noticed that the ice was split up at one part and new ice-holes formed. I determined to make a final effort to penetrate as far, at least, as Taimyr sound, if that were to be our ultimate goal for this year. Meanwhile winter was approaching. The tundras had already long drawn over them their mantle of snow. The temperature of the air stood constantly under zero. That day it was $-2^\circ \cdot 2$ C. (28° Fahr.), the temperature of the sea-level being $-0 \cdot 78^\circ$ C. ($30^\circ \cdot 6$ F.). The chopped ice floated about like a thick stew.

On September 25 we succeeded in clearing out of this bay (called by us Wolf's bay) and reaching the group of Nordenskiöld islands. Stretched between the islands there still, however, lay an unbroken barrier of ice, which, not broader than a few nautical miles, yet opposed an insuperable obstacle to our entrance into the blue open sea spread out, as far as the eye could reach, beyond the islands.

Here the *Sarya* lay at anchor till next day. On September 26 the temperature of the air registered $-5^\circ \cdot 8$ C. ($21^\circ \cdot 56$ Fahr.); that of the water $-0^\circ \cdot 8$ C. ($30^\circ \cdot 56$ Fahr.). All around the ice spread out as a firmly connected mass. Our anchorage lay completely open to every pressure of the surrounding ice. In these circumstances, it did not seem advisable to wait on a north wind springing up to cleave this ice-barrier. I had,

therefore, no resource but to turn about and steer the *Sarya* into the next bay. After a few hours we shot into a sound blocked in the interior by firm ice. Here, for the first time since leaving Kamennye islands, I was able to calculate my topographical bearings from existing maps—from the sketch, namely, given me by Nansen before setting out on the expedition, in which Colin Archer harbour, discovered by him, was recommended as the best resort for first winter quarters. We now steamed exactly by this harbour, in a road forming the western entrance into Taimyr sound. Here, 2 miles from Colin Archer harbour, in a roadstead protected on every side from all ice-pressure, we moored ourselves to a great floe joining us to the mainland, there to have our experience of a first wintering.

In our passage to the east of the Kara sea, it was, then, our fortune to encounter highly unfavourable conditions of ice, caused by the prevalence of E.N.E. and S.S.W. winds, with the abeyance of N. and N.N.E. winds. So soon as the *Sarya* was fast frozen in, and the surrounding ice sufficiently solid, we entered on our wintering preparations—putting in train the tasks connected with our meteorological-magnetic station, and with the hydrological and zoological investigations to be pursued under the ice.

The first half of the winter and two-thirds of the winter night passed quickly, thanks to our regular and many-sided labours. With the return of the sun, which, having disappeared below the horizon on October 31, will not again touch the horizon till February 10, 1901, preparations will be made for sledging expeditions.

PROF. AGASSIZ' EXPEDITION TO THE MALDIVES.

TOWARDS the end of last year Prof. A. Agassiz carried out an expedition to the Maldives for the purposes of studying the physical geography of the group, together with biological research in the waters by which it is surrounded. By the end of January the expedition was back at Colombo, whence the leader wrote to Prof. Dana an account of the main results obtained, which has been printed in the *Ceylon Observer*. From this we take the following condensed summary of the work accomplished and Prof. Agassiz' conclusions respecting the physical history of the Maldives.

For the purposes of the expedition the s.s. *Amra* was chartered from the British India Steam Navigation Company, the vessel being commanded by Captain W. Pigott, R.N.R., under whose superintendence the whole of the soundings carried out (more than eighty in all) were executed. The *Amra* was equipped with a Lucas sounding-machine, which Prof. Agassiz found to possess some advantages over the Sigsbee machine used by him on all his former expeditions; and had in addition a Sir William Thomson sounding-machine for use in moderate depths. The personnel of the party included Dr. W. McM. Woodworth (with general charge of the collections), Mr. Maximilian Agassiz, and Mr. H. B. Bigelow. In the short time available the collections were necessarily somewhat limited, but thirty species of Medusæ were obtained by Mr. Bigelow, while the hauls with the dredge, both from

deep water and from the surface layers within the lagoons, were at times very productive, the latter being found far richer than in the lagoons of any other coral reef region visited by Prof. Agassiz.

Exploration was started from Male island, North Male being first examined, after which the various atolls of the southern part of the group were visited during a southward cruise to Addu, the southernmost atoll of all, and the return voyage northward. The return route was so arranged that the atolls missed on the way south—Wattaru, Felidu, and South Male—were now examined, while in the case of atolls visited on the outward voyage, other parts were examined and the lagoons crossed in different directions, in order that a bird's-eye view of the whole might be gained. The northern part of the archipelago was afterwards examined, and a final exit made through one of the passages on the east face of Ihavandifulu, the northernmost atoll of the group, after a total course of nearly 1600 miles steamed among the atolls of the Maldives.

The soundings made by the expedition were directed chiefly to the filling up of gaps in the existing information, especially with regard to the depths in the channels separating the groups of atolls, and the slopes of the eastern and western faces of the Maldivian plateau. They thus supplement the similar work done by Mr. Stanley Gardiner. On the way back to Ceylon some gaps in the line of soundings previously fixed were filled in, the result being to clearly develop the existence of a wide tongue of ocean, with a depth of over 1500 fathoms, running north of 9°, and separating Minikoi as well as the Maldives from the Indian continental slope. Within the lagoons of the composite atolls no great number of soundings seem to have been taken, as existing charts were considered to give a satisfactory idea of the general topography of the bottom. In some regions the changes in depth are very abrupt, and the character of the bottom varies greatly according to locality and the vicinity of gaps, passes, islands or islets, and sand-bars. On one occasion the claspers brought up a piece of millepore, cut from a living cluster from a depth of 39 fathoms—an unusual depth for a reef-builder, as in the Maldives the reef corals rarely extend below 17 fathoms, sand-lanes and patches usually beginning at 12 fathoms.

The maximum depths of the narrower channels examined were generally found to be between 200 and 350 fathoms, but in some cases much greater depths were met with. Thus 769 fathoms are recorded in the centre of the channel between Miladumadulu and Fadifolu, 374 fathoms between South Male and Felidu, and 649 between Mulaku and Kolumadulu. In the centre of the channel between Gafaru and North Male, only 100 fathoms were found. In the wider channels separating the atolls of the single southern chain, the depths are greater than any yet mentioned. Thus in the centre of the channel between Kolumadulu and Hadumati the depth was 1118 fathoms, and between Hadumati and Suvadiva 1130 fathoms. In the wide channel between Suvadiva and Addu, a depth of 1292 fathoms occurs a little to the north of Fua Mulaku, and 1048 between it and Addu. Owing to rough weather, the line could not be continued beyond Addu towards the Chagos group. The bottom samples of the deeper soundings were interesting as showing the existence of Globigerinæ in great quantities at a comparatively short distance from the shallower waters of the Maldive plateau; they were frequently so abundant as to form what might be called Globigerina sand. Nearer the atolls Pteropod shells were common, especially on the outer face of the groups, and in two cases small manganese nodules were brought up from the bottom of the channels.

The soundings taken on the east and west faces of the plateau are said to indicate a comparatively steeper slope off the western than off the eastern face,

Thus 8 miles west of the southern part of North Malosmadulu the depth was 1247 fathoms, and at a similar distance off the south-western face of Ari, 1499; while east of South Male 1270 fathoms were found at a distance of 12 miles. Yet the soundings on the charts quoted by Prof. Agassiz indicate a depth of over 1000 fathoms off the south-western face of Ihavandifulu at a distance of nearly 12 miles, while off the north-east face nearly the same depth is reached in less than 6 miles. In the wide basin which separates the eastern from the western chain of atolls, the depths varied from 519 fathoms (between Fadifolu and South Malosmadulu) to 186 fathoms (5 miles west of North Male). The bottom of all the channels separating the composite atolls appears to be flat; the soundings drop rapidly, and generally at a distance of a mile and a half from either face they reach a depth but little inferior to the greatest depths in the centre of the channels. The greatest depths thus far obtained in the channels separating Minikoi from the northern Maldives (1179 fathoms) and from the Laccadives (1197 fathoms) are about those which separate the southern Maldives from one another and from the central part of the group.

Both Minikoi and the Laccadives, as well as the southern and northern Maldives and some others, rather resemble such Pacific atolls as characterize the Ellis and Gilbert groups than what has been called the composite Maldivian atoll. A glance at the Admiralty chart will show the great difference in structure between such atolls as Makunudu, Kardiva or Addu, and groups like North and South Male, North and South Malosmadulu, and others. Again, such atolls or groups of atolls as Fadifolu, Felidu, and Mulaku combine features characteristic of the Maldivian atolls with those of many Pacific forms; while others like Kolumadulu, Hadumati, and Suvadiva recall some of the larger Pacific atolls in the Marshall, Ellis, Gilbert, or Caroline groups, noted for the absence of shoals or islands in the lagoons, and contrasting with the typical agglomeration of the small Maldivian atolls along the 30 to 40 fathom belt of the great plateau, which have grown up as distinct parts and are separated by deep channels. Although in such clusters as North and South Male the well-marked rims recall the rims of the great Pacific reef-flats, it is in the structure of such groups as Miladumadulu and Tiladumati that we obtain the key to a rational explanation of the formation, in general, of the atolls and groups of atolls in the Maldives.

These two groups are not themselves atolls in any sense of the word, but are made up of a great number of small atolls, often separated by considerable distances, which have grown up from depths of 25 to 30 fathoms. They can be seen, as in North Male, in all stages of growth, from the flats or mere rings not rising more than 5 or 6 fathoms from the top of the plateau to the rings just awash, or with sandbanks rising a foot or so above the surface. The shape need not be circular, being controlled by the topography of the bottom. In some cases the lagoons of the smaller atolls have been formed by the growth, lagoonward, of patches or lines of coral which have eventually become joined. There is no evidence that these small atolls are the result of the splitting-up of larger atolls, or that adjoining atolls or reef-flats have coalesced, except where the passages between have been of very moderate depth.

The outer slopes of the rings, to a depth of from 8 to 12 or even 15 fathoms, are characterized by a luxuriant growth of coral, contrasting strongly with the scanty growth in the lagoons of the Pacific atolls. This is explained by the wide and deep passages through the rims of the so-called atolls, which passages are generally larger than the space occupied by the small atolls (atollons). As soon as the flats of the rings have reached the surface, sand-bars form and develop into islets, and finally into islands with scrub vegetation and bushes, and sometimes large trees. The rings, or "faros," either retain a central lagoon, or it becomes wholly or partially

filled up by the growth of the land. It is comparatively easy to trace the progress of growth through all the various stages.

The small atolls which form the outer rim of the composite atolls owe their existence to the same causes, and the increase in size of the islands goes on much in the same way as has been observed in the Gilbert, Ellis, and other Pacific groups. Small islets on the same reef-flats are gradually united by the formation of sand-spits on the lee face, thus forming bays on the sea face which are gradually filled up, the former gap being indicated in time merely by a difference in the vegetation, a distinction which gradually disappears. The existence of lagoons completely shut off from the sea in some of the northern atolls can be similarly explained. At first there will be merely a crescent-shaped island, between which and the rest of the reef-flat of the ring there is comparatively deep water. Spits are thrown out from the horns of the crescent, and finally unite so as to form an ideal atoll—a closed ring of land enclosing a deep lagoon, which exists so rarely in nature. The change from an open crescentic island to a closed atoll may take place with considerable rapidity, as is shown by comparing the charts of seventy years ago with the state of things now existing, various crescentic islands having increased in size by the extension of the sand-spits, while one at least—Rodularmandu—has, during the seventy years, become a closed land-ring. Fresh water or brackish sinks edged with mangroves can be traced to the operation of a similar process.

These facts, Prof. Agassiz says, point to the uselessness of our present definition of atolls, as every possible gradation can be seen between an open crescent-shaped bank and an absolutely closed ring of land. The evidence of a great number of atolls scattered over an extensive plateau like that of Tiladumati and Miladumadulu shows that reef-corals will grow upon any foundation where they find the proper depth, and that local conditions will determine their existence as fringing reefs, barrier reefs, or atolls. In fact, reefs that once formed an atoll may, when this becomes an island, be transformed into fringing reefs. The composite atolls are merely elevations upon the greater Maldive plateau, which have served as bases, at the required depth, to the reef-building corals; while the secondary plateaux have in turn supplied a number of bases for the formation of atolls. The variation in type in different parts of the group may be ascribed to the varying conditions of exposure to ocean currents.

The effect of the monsoons in the Maldives cannot be compared to that of the incessant breakers which pound upon the reefs and atolls of the Central and Western Pacific, and the boulders thrown upon the reef-flats are pygmies beside the gigantic blocks which often line miles of the beaches of the Pacific atolls. But the same forces are at work, only on a diminutive scale, even during the south-west monsoon. Both sand and shingle beaches are as a whole remarkably steep. They rarely rise to more than 5 or 6 feet, though in some of the northern atolls they are fully 12 feet high. All the reef-rock examined was found to be of the most modern character, and no trace was seen of rock indicating the nature of the underlying plateau, as would surely have been found if existing conditions had been brought about by subsidence. The only evidence points to a very slight elevation having taken place.

Prof. Agassiz praises the accuracy of the charts based on Captain Moresby's survey, which, he says, is something wonderful, when we remember the conditions under which that survey was executed seventy years ago. They proved an unerring guide for the intricate navigation among the Maldives, and though some minor changes have occurred in the interval, they are still a monument of the unsurpassed skill of the surveyors of those days.

A PROPOSED EXPEDITION TO THE NORTH MAGNETIC POLE.*

By Captain ROALD AMUNDSEN.

THERE are, as you are aware, magnetic forces in the Earth which cause the compass-needle to assume a certain position at each place on the Earth's surface. The north end of the needle points northwards, but not exactly in the direction of the geographical north pole. At some places it points east of the true north, at others west. If we were to imagine expeditions starting from various places on the surface of the Earth, and each moving forwards always in the direction indicated by the north end of its compass-needle, these expeditions would at last all meet at a point situated on Boothia, the most northerly peninsula of the American continent. This point is called the magnetic north pole of the Earth. If, on the contrary, these expeditions had taken the direction indicated by the south end of the needle, they would have met at last at a point on the antarctic continent—Victoria Land, near the south pole. This point is called the magnetic south pole of the Earth. These two magnetic poles are also remarkable from the fact that a so-called magnetic dipping-needle—that is to say, a magnetic needle that is movable about a horizontal axis—will at these places assume a vertical position, with the north end downwards at the magnetic north pole, and with the south end downwards at the magnetic south pole, while everywhere else its position is oblique; that is to say, making more or less of an angle with the horizontal plane. This angle is called the magnetic dip. Thus the dip at the Earth's two magnetic poles is 90°. The lines passing through all places with the same dip are called isoclines. The isoclines run round the Earth from east to west in the form of continuous lines. The isocline passing through all places at which the inclination is 0°, in other words, at which the needle assumes a horizontal position, is called the Earth's magnetic equator. It intersects the geographical equator in two points, in such a manner that about half of it, on the western hemisphere, lies south of the equator, and the other half, on the eastern hemisphere, north of the equator. The farther we withdraw from the magnetic equator, the greater is the dip of the north end of the needle in the northern hemisphere, and of its south end in the southern hemisphere, until we come to the magnetic poles, where, as I have said, the inclination is 90°.

In August, 1897, the Belgian South Polar Expedition, with its ship, the *Belgica,* on which I had the honour of being first officer, set out for the antarctic waters. The aim of the expedition was to reach South Victoria Land, and there endeavour to determine the exact locality of the magnetic south pole, of which the position is only approximately known. Plans subsequently made, however, carried us into the ice about Graham Land and Alexander Land, where we lay for thirteen months, frozen into the antarctic drift-ice west of Graham Land. It was here, in 72° S. lat., that the idea of getting to the magnetic north pole and exploring its surroundings first presented itself to me. During the long and comparatively idle winter, our original plan, of determining the position of the magnetic south pole, was of course constantly discussed, and this raised in its turn animated discussion of the question of terrestrial magnetic matters in general, and the situation of the magnetic north pole in particular. Some of the scientific men on board were of opinion that the position of the magnetic north pole was

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* A Lecture delivered before the Norwegian Geographical Society in Christiania, November 25, 1901.

fixed by the determinations made by Sir James Ross in 1831; while others thought that it probably moved a little in the course of time. These discussions awakened a keen interest in me, as I daily had the opportunity of seeing the magnetic instruments we had with us in use, and also now and then of assisting in the taking of the observations. I gradually became more and more desirous of going up myself to arctic North America, and of investigating the conditions around the magnetic north pole, where no one has been since Ross.

Upon my return from the Belgian Expedition in 1899, I immediately began to collect all the works upon this subject that were to be found. The book I sought for longest, but did finally obtain, was Sir James Ross's account of his journey and his investigations on the subject of the magnetic north pole. On reading this book, my longing to find the so-little-known magnetic centre was still further stimulated, and I determined to confer at once with men versed on the subject, as to whether my project could possibly bring to magnetic science any results worth mentioning. With this view, I first applied to the assistant director of the Meteorological Institute in Christiania, Hr. Axel Steen, whom I knew to be at that time engaged in working up the magnetic observations of the *Fram* expedition. Hr. Steen, who immediately expressed his entire sympathy with my plan, and kindly promised to assist me with advice and information, was of opinion that I ought first to make myself acquainted with the magnetic instruments in the observatory in Christiania and with their employment, and then seek an opportunity for more advanced magnetic study at the Deutsche Seewarte in Hamburg. When, acting upon this advice, I applied to the director of the Christiania Observatory, Prof. Geelmuyden, I was received in the most kindly manner, the professor himself showing me the instruments, and giving me some valuable instruction in the various methods used in the determination of the terrestrial magnetic elements.

In the autumn of 1900 I went to Hamburg to see the director of the Deutsche Seewarte, the renowned magnetician Prof. Neumayer, to whom Hr. Axel Steen had kindly given me a letter of introduction. I shall not soon forget my first meeting with the celebrated Geheime Admiralitätsrath, and I must be permitted to describe it in a few words. I was announced and shown into a characteristically furnished workroom, where I found myself in the presence of an elderly man with long white hair. After the usual exchange of civilities, I soon became aware that my stock of German words was becoming exhausted. In vain did I tax my memory to the utmost; I was completely at a loss. How agreeable was my surprise, therefore, when the professor, quickly grasping the situation, came to my rescue by continuing the conversation in English. I now managed comparatively well, and laid my plan before him. To my question as to whether a closer investigation of the position of the magnetic north pole would be of great interest, he replied, "An exact determination of the Earth's magnetic north pole will be of immense value to science." Whatever doubts I may have previously entertained about venturing upon the realization of my contemplated undertaking, they were instantaneously dispelled by this answer, coming as it did from the greatest authority of the present day on the subject of terrestrial magnetic investigations. During the time that I now worked at the Deutsche Seewarte, I was treated more as a welcome guest than as an unknown stranger; and the kind old director himself superintended my studies all the time. The magnetic laboratory was placed at my disposal, with the necessary instruments. The laboratory was the same in which Captain Scott-Hansen, of the Norwegian Navy, had worked before his departure in the *Fram*. I worked there every day, and soon became acquainted with the instruments and methods of observation. The calculation from observations I learnt under Prof. Neumayer's assistant, Dr. Maurer. It was with sincere

regret that I bade farewell a couple of months later to the Deutsche Seewart, with its agreeable and obliging staff. On my return to Christiania, I called upon Prof. Nansen, and laid my plan before him. He promised me his valuable advice in the matter of equipment. Being myself so inexperienced, I am deeply grateful for this kind offer from the greatest polar explorer of the age.

In January of the present year (1902) I went to Tromsö to look for a vessel that would be suitable for my contemplated expedition. I there purchased the whaler *Gjöa*, which is renowned as one of the strongest and best sailing-vessels in the arctic fleet. The reason of my buying it so early was that I wished first to make a voyage in her in the Arctic ocean, and become acquainted with her before starting on the actual voyage. On this arctic trip, which lasted from April to September, I had plenty of opportunity of judging of the qualities of the vessel.

Acquaintance with the various ways in which the Earth's magnetic forces manifest themselves dates back to an early period of history. It is true that the inventor of the mariner's compass is said to have been an Italian, Flavio Gioia, who lived at the beginning of the fourteenth century; but the Chinese are said to have known and employed a special form of this instrument long before our era. It was not, however, until the beginning of last century that the study of terrestrial magnetism, and the consequent collecting and working out of observations from various parts of the Earth, began to increase. I will here only mention the names of my countryman, Hansteen, and the German, Gauss. The numerous English expeditions sent out in search of a north-west passage brought the question of the position of the magnetic north pole into frequent discussion; and Ross's, Parry's, and Franklin's expeditions made it their special aim to obtain observations for the determination of the Earth's magnetic elements. This question, it is true, played a very secondary part in comparison with that of finding the desired north-west passage; but quite a valuable collection of magnetic observations was nevertheless obtained.

The honour of having practically determined, by his investigations, the position of the magnetic north pole is due, as I have already said, to the Englishman, Sir James Clark Ross. His uncle, Sir John Ross, was the leader of the expedition, James being the second in command. The object of the expedition was to find and force its way through the so-called north-west passage with the paddle-steamer *Victory*. It left England in 1829, and passed through Lancaster sound southwards through Prince Regent inlet, where it was hoped a way would be found westwards. The vessel was frozen fast in the ice in the Gulf of Boothia, and the expedition was forced to spend four winters in this region. During this long detention in the ice, they frequently met with Esquimaux who had never seen a European before. The *Victory* never came out again, and officers and crew had to make their way back by the aid of the ship's boats; and were at last rescued at the mouth of Lancaster sound by the barque *Isabella*, which had been sent out in search of the missing expedition. Though unsuccessful in its main object, the scientific results obtained were brilliant. It was after one of the winters thus spent in the ice that James Ross, on May 27, 1831, started on a sledge-expedition with the magnetic north pole as its goal. I will not weary you with details, but only quote a few fragments of his description of the journey. On June 1 he writes: "We commenced, therefore, a rapid march, comparatively disencumbered as we now were; and, persevering with all our might, we reached the calculated place at eight in the morning of June 1. I believe I must leave it to others to imagine the elation of mind with which we found ourselves now at length arrived at this great object of our ambition; it almost seemed as if we had accomplished everything that we had come so far to see and to do; as if our voyage and all its labours were at an end, and that nothing

now remained for us but to return home and be happy for the rest of our days." After expressing his opinion as to how another expedition ought to proceed in order to determine more accurately the position of the magnetic north pole, he says: "Having thus therefore stated, however briefly, what yet remains for future observation—having pointed out what, I may fearlessly say, is still wanting, and which, as such, claims the attention of those who have the power of promoting a work of this nature, I can only express my wishes, if I dare not indulge in hopes, that the same nation which has already carried its discoveries so far, that our own Britain which has already established its supremacy in scientific and geographical researches, will not now abandon them, and leave to others to reap the crop of which it has in this case sown the seeds."

James Ross thus arrived on June 1, 1831, at a spot where the dipping-needle showed an angle of 89° 59′ with the plane of the horizon—in other words, was only deflected one minute from an absolutely vertical position. Practically this one minute is of little consequence, and Ross himself considered that he had now really reached the magnetic pole, whose geographical position he accurately determined to be 70° 5′ N. lat., 96° 47′ W. long.; and, satisfied with this result, he ceased all further investigations, and has thus contributed nothing towards the solution of the question that has since presented itself, namely, whether the magnetic pole is actually only a point, or whether possibly the peculiarity of the needle assuming a vertical position extends over a large area. Theoretical study of recent times points decidedly to the latter supposition. Another question that also demands a practical solution, and which I have already briefly touched upon, is whether the magnetic pole is stationary, or changes its position. It is the solution of these two questions that I have set myself the task of attempting.

I will now pass on to a brief account of the equipment, the route, and the manner in which I have thought of carrying out my plan. I shall start in the spring of 1903 in my vessel, the *Gjöa*. We shall be seven men on board, all told. The reason of my preferring a small vessel like this is that the waters which we shall navigate are very frequently narrow and shallow, and it is thus important to have a vessel that does not draw much water, and at the same time is capable of turning in its own length. A small vessel, especially one of the sloop build, requires a smaller crew, and is in consequence cheaper to fit out. The *Gjöa* is only a sailing-vessel, but I am going to have her fitted with a petroleum engine next year. This I regard as quite necessary, considering the difficult waters we shall have to navigate. The equipment will consist of the usual things required for a polar journey, such as fur clothing, tents, ski, snowshoes of various kinds, sledges, kayaks, etc., as also provisions for four years. Among the magnetic instruments is a travelling magnetometer of Prof. Neumayer's construction. This instrument will resemble that on board the *Fram*, but will be furnished with even more improvements. It has now been in the hands of the Deutsche Seewart's instrument-maker, Hr. Carl Seemann, for a year, and will not be ready until the spring. Owing to the warm interest he takes in my expedition, Prof. Neumayer has designed it especially for this occasion, and has personally superintended its construction. There is, therefore, no doubt but that this instrument will be perfect in every respect. There is also an inclinatorium under construction at instrument-maker Dover's in London. Dr. Charles Chree, the director of the Kew Observatory, has most kindly promised to superintend the construction of this instrument. Thus as regards magnetic instruments, I think I may safely say that I am taking as complete and up-to-date an equipment as the fulfilment of my task can require. The meteorological instruments are barographs, barometers, and thermometers.

The oceanographic instruments I hope to be able to take, are sounding-machines,

deep-sea thermometers, and appliances for taking water-samples and bottom-samples. Among other instruments may be mentioned those necessary for navigation and sledge-journeys, such as sextants, artificial horizons, chronometers, and good watches. Petroleum will be used for the heating of the vessel when under way. I shall also take as much coal as space will permit, for use in the galley. During the winter I hope to be able to supplement our store of fuel with drift-wood. On our way westwards, it is my intention to visit one of the Danish colonies on the west coast of Greenland, for the purpose of taking thence some Esquimaux dogs, which will be of great service to us. We shall then make for Lancaster sound, where I hope to be by the middle of July. The course will continue through Lancaster sound and Prince Regent inlet to Bellot strait, where McClintock was stopped by the ice in 1858, when searching for the Franklin Expedition. Should the ice-conditions prove favourable, I intend to go on through Bellot strait, and make my way along the west coast of Boothia, leaving a depôt, if possible, at the spot where Ross found the magnetic north pole in 1831, and then seek for a suitable winter haven, either in Matty island or King William Land. Magnetic observations will be taken as often as opportunity affords. The autumn, 1903, will be employed in making depôts for the coming year. The winter will be employed in making magnetic and meteorological observations. I shall give special attention to the action of the magnetic forces during the occurrence of aurora borealis. Daily observations of ice-information, high and low water, etc., will also be taken. I have thus no doubt but that every man's time will be occupied. As soon as the severest part of the winter is over, I shall set off with three men, two sledges, and as many dogs as we may have, and make for the place on Boothia at which Ross observed the inclination-needle to make an angle of 89° 59′ with the plane of the horizon, making observations all the way. Here, in the first place, a long series of careful observations will be made, after which, taking this spot as the starting-point, I intend to investigate the surrounding region in all directions regarding its magnetic conditions, with determinations of variations, intensity, and inclination, endeavouring, by a choice of stations, to encircle the magnetic north pole, or the region within which the needle assumes a vertical position. The second sledge will be sent back as soon as its aid can be dispensed with, with orders to see to the maintenance of the depôts. I hope, before the winter sets in, to have carried out the principal part of my programme, and in that case I intend to pass the following winter, 1904–5, with one companion, as near as possible to the magnetic north pole. The matter of supplies for my companion and myself, I think of arranging by replenishing the depôts so much during the summer months that they will also be sufficient for winter needs. As observatory and dwelling-house for my companion and myself during this winter, I intend to erect snow-huts after Esquimaux fashion. If my intention is carried out, we shall not be the first civilized men who have passed a winter under a snow-roof; for Dr. Rae, a traveller for the Hudson Bay Company, spent an entire winter with his men here on the north coast of North America, and found it an excellent way of wintering. I have myself had an opportunity of making experiments in this matter, and have found that even in a temperature of −40° C. a dwelling of this kind forms a warm and comfortable abode. Both the first and the second winter, I shall try to set up both the inclinatorium and the declinatorium as variation-instruments, so that regular hourly readings may be taken in connection with aurora borealis observations. The meteorological observations will always be attended to on board.

In the spring of 1903, I think of repeating the work of the previons summer as a check, visiting systematically the old observation points, and there, or in

their immediate neighbourhood, taking a new series of absolute determinations of terrestrial magnetic elements. If this can be accomplished, I shall consider that the object of my journey has been fully attained. Our concern will then be to get back to the ship, and if this is accomplished in the still navigable part of the season, and the ice to the west should prove to be possible of penetration, I shall continue in that direction with the vessel, still taking magnetic observations as frequently as possible. I hope to be able to keep up the meteorological observations all the time without interruption. It is then my intention to make the return voyage, if all goes well and circumstances are favourable, by way of the north-west passage. I have now briefly sketched the plan of which it is my purpose to attempt the realization. It is, of course, possible that circumstances may compel me to alter it in some important points, and I am not blind, moreover, to the numerous difficulties with which I shall have to contend; but I set out with confidence, hoping to return with results which, to some extent at any rate, may prove valuable for scientific investigation.

REVIEWS.

EUROPE.

Britain and the British Seas.

By HUGH ROBERT MILL, D.Sc.

We welcome this first volume* of a new and important series with a pleasure enhanced by anticipation and not diminished by perusal. The book is new, fresh, and forcible, abounding in unexpected theses handled with the skill one looks for from the author. It is obviously the fruit of thought and of wide reading, and invites the geographical public to enjoy its well-elaborated substance, while it tempts the critic to investigate its structure by dissection. The book, and presumably the series, does not compete with any other in the field, but approaches the desirable ideal of illustrating geographical principles by the facts associated with particular localities without giving an exhaustive geographical description. We are much accustomed to geographical writings in which ill-drilled details are put together anyhow, and drift aimlessly to no particular end. There is nothing of that kind here. Every fact brought forward points like an arrow on a map of the winds to a definite conclusion.

Of the two philosophical methods which might be employed in such a work, Mr. Mackinder has apparently chosen the deductive, which is indeed the only way by which a great body of material can be dealt with in a very limited space. It is by far the more attractive also, for it allows of great definiteness of treatment and the citation of a minimum of data, while it gives to the reader the pleasure of discovering

* 'Britain and the British Seas.' By H. J. Mackinder, M.A. With Maps and Diagrams. London: William Heinemann. 1902.

innumerable coincidences of fact with theory. The drawback is that the unanimous trend of facts thus detected has precisely the same logical force as the unanimous resolution of a political meeting to which the public is admitted by careful selection. It involves the choice and maintenance of a theory—originally based on the facts it is brought forward to explain—but does not require that the laborious reasoning which led to its acceptance should be set forth. Hence it is not necessary, in this place, to discuss the basis of the theories from which the deductions are made, though we feel that some, at least, of them are still open to controversy. We are concerned in seeing what are Mr. Mackinder's geographical deductions from the geological and historical theories which he has accepted, and in examining the manner in which he sets them forth.

In the Summary and Conclusion at the end of the volume we find a terse epitome of the whole argument, a slight abridgment of which will convey the best general view of Mr. Mackinder's aims, and of the nature of the facts with which he deals.

Britain is viewed in two historical aspects as it is approached: (1) on the south-east from the continent across the Strait of Dover to the Kentish peninsula and the Thames estuary, leading to the English plain whence land-ways radiate to the higher oceanic border on the west; and (2) over the ocean from the south-west towards the Channel entries whence waterways diverge between the lands. The contrast is similar to that presented in Scandinavia, which may be viewed as formerly continuous with Britain along the west, while the configuration of Scotland indicates a rock-graining from south-west to north-east, which may be interpreted as a relic of a Caledonian mountain range which once crossed what is now the North Sea. The general equality in height of the higher summits of Scotland, and the run of the southerly trending valleys transverse to the rock-graining, can only be explained by the whole surface having been worn down to a base-level and then re-elevated in a vast plateau (called Atlantis) spreading from the British uplands towards Iceland and Greenland. From a portion of this plateau the existing configuration was carved during a fresh cycle of denudation. The greater part of the plateau of Atlantis, meanwhile, collapsed, forming the two oceanic abysses separated by the Scoto-Icelandic ridge, of which the line of median uplands in Britain is a continuation, and no doubt due to the same terrestrial stresses. In front of the south-eastern shore-line of the Caledonian continent a mass of ancient land (on the site of Wales and the Irish sea), which may be called Proto-Britain, was formed; and when the stresses which produced the Earth-folds known as the Hercynian system took place, the resistance of this block diverted their direction, and so determined the triangular outline of Britain. These folds sheltered the coal-basins of Great Britain in their hollows, while the coal-beds of Ireland,

protected from disturbance by Proto-Britain, remained exposed, and were afterwards removed by denudation. A later uplift raised the Wealden fold and brought Britain into physical contact with the continent, the English plain of soft rocks being the eastern coastal plain of the great ancient continent of Atlantis, not the western coastal plain of Europe.

The oceanic gulf which takes the place of Atlantis determines the climate of Britain by opening a way for warm air and a procession of cyclones, while the higher land lies obliquely to their path, and so produces climatic contrasts between the east and west harmonizing with the structure.

Similar harmonies are found with regard to the historical aspects of geography; the east side of the British triangle is opposite the Baltic lands, whence the lighter people spread westwards, while the south side (through France and the gap between the Alps and Pyrenees) faces the Mediterranean lands, whence the darker people spread northward. The radial advance of later conquerors from Kent is illustrated by the terminal remnants of Celtic speech on the ocean border. The four parts of the realm are structural as well as historical units, Wales representing Proto-Britain, while before the industrial revolution the three kingdoms were essentially three lowlands separated by boundary-belts of upland or sea.

The English lowland consists of the soft, tilted, overlapping strata, characteristic of a coastal plain, resting on a buried plain of ancient rock containing coal-basins which are exposed in the north-west. The continental climatic system frequently overspreads this plain, the chief properties of which are breadth, arable fertility, and potentiality of mechanical power. Ireland, on the other hand, with its plain of nearly undisturbed strata lapping round ancient bosses of upland, has no coal, a less complex soil, and an oceanic climate; its surface is consequently generally meadow or bog. The Scottish plain is the smallest, but has a store of coal, and on the lee side rewards cultivation.

"The sites of the three capitals strikingly exhibit the effect of these contrasts. London, in the continental angle, but not far removed from the midst of the English lowland, is a focus of many ways radiating freely over the plain. The most important is that which enters through Kent, and leaves through the Cheshire gap.

"Dublin, opposite to Cheshire, is in the broad coastal entry of Meath, whence roads diverge northward, westward, and southward through gaps among the engirding uplands.

"Edinburgh is in the defile between the Pentlands and the coast, at the head of the sill-entry to the enwalled rift-valley.

"Finally, a vast imperial nodality has been accumulated in London during the centuries characterized by oceanic mobility."

It is plain that a book which seeks to trace the effects of the early

geological movements of the Earth's crust in the latest agglomerations of human population on its surface is not one for careless reading. The attempt to give expression to the ideal is splendid in itself, and we feel that it ought to be successful. But we feel, also, that it is an essay boldly trying to picture what may have occurred rather than a treatise solidly proving what has taken place. It depends for the success of its main contention on the accuracy of the hypotheses of Suess and Davis, hypotheses which are not yet fully accepted by all geologists. These would be legitimate matters for criticism if we viewed the work as an induction from facts; looking on it as a deduction from theories, they do not concern us at the moment. If it is not a logical chain riveted with demonstrated facts, it is at least a garland skilfully arranged and bound together with an attractive thread of probability. It gives fresh interest to a well-worn theme, and should afford useful and stimulating study for geographical students.

Writing in a geographical journal, it is permissible to look somewhat closely into the mode of setting forth the argument of the book, and we wish first to direct our attention to some of the terms employed, although we meet the difficulty of deciding whether these are always meant to be geographical or sometimes to be only literary expressions. Writing in the *Geographical Journal*, we may venture to inquire why the name of the planet is written with a small initial, for in these pages the disrespectful instinct of the compositor is checked, and the Earth is distinguished from the earth. It is true that books usually, and newspapers always, follow the habit; even the paper which gives a capital to the article in its own name—*The Times.* Were it only to guard against the ambiguity in the use of the word *earth* for soil and for the planet, we feel that the capital distinction should be observed. Another point—and this is a trivial one—touches on the use of the article. Mr. Mackinder omits "the" before Solway Firth or Moray Firth, giving a sense of unfamiliar abruptness; probably there is something to be said in favour of the curtailment, yet if so, why (p. 58) "the Great Orme's Head"? It is possible that we may look with too proprietary an eye on the firths, but, setting aside the question of title, the fundamental distinction between the fiords of the west of Scotland and the rias of the west of Ireland is not made plain on p. 22. A ria will not become a fiord sink it never so deeply, as indeed the reader will find implicitly stated when he comes to p. 82.

The word *sill* has been used for generations, if not for ages, to denote geographical features, such as the Great Whin Sill, a prominent volcanic dyke, or the ridge at the entrance to a fiord basin, where the analogy to a dock-sill is very apt. But Mr. Mackinder makes use of sill in a sense that is quite unusual, and we do not see that he anywhere defines the term, if, indeed, he uses it as a definite term and not merely as a general word. It is used apparently for a terrace, raised beach, or

alluvial flat on p. 17, for a belt of comparatively flat land such as a coastal plain in many places, and it is also applied to the continental shelf or to parts of that feature. A sill, be it window-sill, door-sill, or dock-sill, seems naturally to suggest a ridge or narrow elevation between two areas at lower levels, and if applied otherwise should be carefully defined. If the book were to be translated into German, the word *Schwelle* (probably the original form of *sill*) would naturally be used, with very confusing results.

The word *gap* is also used somewhat curiously. As a rule, a gap is taken as implying an abrupt depression between high lands. On p. 285 the site of Edinburgh is thus described: "Between the end of the Pentlands and the coast of the Firth there is a gap, in the midst of which is the Castle rock, and around this, in the gateway leading to inner Scotland, has grown up the capital city of Edinburgh." We have already quoted a passage in which this feature is called a "defile." In either case the words are loosely handled. Viewed from the firth, Edinburgh is seen to stretch along the lower slopes of the Pentlands; from the hills it seems to stand on the plain at their foot. The North British railway certainly does traverse the centre of Edinburgh in a hollow, not a natural gap or defile, however, but a lake-bed artificially drained and embanked; and the Castle rock owed its ancient vantage to the fact that it was the most abrupt eminence of moderate height in a fairly extensive plain, furrowed slightly from east to west, but, as a whole, sloping gently northward to the sea.

One other example, out of several, may be referred to in which definite terms are stretched beyond the limits of their natural elasticity. On p. 292 the author considers that "for the purpose of general description it is convenient to extend" the name of Strathmore to include parts of two different river-basins. But the essence of a strath is that it borders the track of a single river-system. No doubt an argument could be derived from Glenmore, which drains in opposite directions; but the real continuity of the glen differs much more decidedly in nature than on the map from the entire discontinuity of the "extended" strath. In the map on p. 131 the "Strathmore Belt" is shown running through Loch Lomond into the Firth of Clyde, coinciding with what is usually called the line of the Great Fault. The lowland valley of Scotland could be better dealt with by treating it as a plain bounded by the highlands and the southern uplands, and broken by low hills of volcanic rock. The real geographical significance of the old place-names would then require no extension or modification.

Our last criticism as to terminology touches on an old controversy. Are the names applied by Prof. Davis to types of rivers adapted for use in a book not intended solely for the specialist? Mr. Mackinder is not averse to the use of technical names which are sufficiently unfamiliar to lead a careful reader to light upon the defects of his dictionary—

nigrescence, *nodality*, *posthumous Hercynian uplift*, and *sigmoid*, for example so that he is not likely to prefer an expression that is ambiguous simply because it is already familiar. To call a river *consequent* because its course is a direct consequence of the original slope of the land is perfectly right, and to call a river *subsequent* because it owes its course to events subsequent to those which produced consequent rivers is not wrong; but once the mind is accustomed to associate these far-reaching connotations with the words, it pauses in instinctive search for some similar meaning before such phrases as "the subsequent kingdom of Scotland" (p. 204), or "consequent wind-swirl" (p. 161). Being free from these objections of pre-occupation, *obsequent* may be hailed as a sort of Mesopotamia of river-terms, though it is not in itself a beautiful word. It seems to us that geographical terminology might take a hint here from the terminology of organic chemistry, and employ some such prefixes as ortho-, meta-, para- to qualify such river-courses as require differential treatment. We suppose that it would be hypercritical to cavil at the contraction of the phrase "an obsequent river" into the crisper substantive form of "an obsequent;" but when such a term is used we think it should be defined.

We fully agree that the conception of development in river-basins with the capture and beheading of rivers, is a most valuable one and very helpful to the student; but the whole group of ideas is still very unfamiliar and difficult. It requires clearer explanation than has been given, and we would like to have seen it handled with the clearness and firm grasp evinced, for example, in the chapters on weather and climate.

We have dwelt at some length on the matter of terminology, for we consider it to be the weakest point of a remarkably powerful book, sometimes obscuring to the reader a meaning which was perfectly clear to the author. We have no objection to the introduction of new terms, and, indeed, consider that it would be an advantage if more were introduced; but they should be carefully chosen to express definite conceptions without ambiguity; they should be very carefully defined, and used no less scrupulously than the terms of mathematics or of seamanship. The exacter handling of language is a desideratum in all literature, and we consider that to use a word which may suggest different ideas to different minds is always wrong, when it is possible to use a word or phrase that can convey only the desired meaning to every reader.

We might call attention to many instances in which facts have been overlooked to the detriment of some particular thesis; but believing that the facts which are cited were intended to be illustrative and not exhaustive, we consider that the real object of the book has been as successfully carried out by the employment of a selection of relative facts as it would have been by a summary of the whole. The references to authorities are somewhat scanty. No reference is

made to 'British Rainfall,' the acknowledged authority on that department of our climate, nor to Scharf's valuable 'Origin of the British Fauna;' but an adequate bibliography would have swollen the work far beyond its very moderate limits of space.

The chapters on racial, historical, and economic geography, and those on Metropolitan and Industrial England, we believe to be by far the best treatment of those subjects that has yet appeared. The account given of the origin of the existing counties is particularly valuable, for the facts have never been brought together before.

The book is illustrated by expressive orographical maps of England, Scotland, and Ireland, a vegetation map, and a generalized geological map on a small scale, all specimens of Bartholomew's best work in clear draughtsmanship and delicate colour-printing. The text is plentifully illustrated by sketch and diagram-maps, in most cases very skilfully treated. One device which produces a happy result is to disregard the conventional orientation, and to place the portion of country dealt with upon the page so as to bring its most prominent features parallel with the edges of the paper without reference to direction; the only possible objection would be obviated if an arrow showing the direction of the meridian were introduced unobtrusively.

If the authors of the remaining works in the series succeed in following the lead of their editor, the literature of geography will be enriched by a wealth of organized learning worthy of the dawn of the twentieth century.

AFRICA.

Rhodesia and the Ophir Problem.*

In our recent notice of Prof. Keane's 'Gold of Ophir' † (March, p. 361), it was pointed out that the main questions associated with this secular problem were twofold: "the original source of the gold of Ophir, and the locality of Ophir

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* 'The Ancient Ruins of Rhodesia.' By R. N. Hall and W. G. Neal, with over 70 Illustrations, Maps, and Plans. London: Methuen. 1902.

† The review of this book, which appeared in the March number of the *Journal*, may possibly, though quite unintentionally, convey a wrong impression as to the original value of Prof. Keane's researches, and thus fail to do justice to the really remarkable character of the work, and the wealth of erudition as well as the skill in piecing together the various elements of the question displayed by the author. Apart from the central idea of the work—that Ophir was the distributor, not the producer, of the gold (the originality of which was fully conceded in our review)—Prof. Keane has shed new and valuable light on many interesting points, among which his extension of the Babylonian zodiac to the proto-Aryans, as evidence of the great antiquity of the Zimbabye monuments, and his elucidation of the Himyaritic rock-inscriptions, deserve special mention. Even where the fundamental idea is not absolutely new, as in the case of the early Semitic intercourse with Madagascar, the careful elaboration of the evidence and the abundance of detail never before brought forward, entitle the work to rank as a solid contribution to knowledge, of permanent value to historical and archæological students.—Ed. *G. J.*

itself." Broadly speaking, that book is primarily concerned with the latter question, while Messrs. Hall and Neal's handsome and richly illustrated volume deals almost exclusively with the former. Between them they thus cover the whole ground, and general assent will probably be given to the statement made by the author of 'Ophir' to the authors of 'Rhodesia,' and quoted in their preface, that "the two books should thus be complementary of each other; between us I hope we shall succeed in settling this question in all its bearings once for all." On the one essential point both are indeed in full accord, concluding with almost irresistible force that the golden Pactolus which streamed into Tyre and Jerusalem in Solomonic and even pre-Solomonic times, had its sources in the present Rhodesia, or, taking it in its widest sense, in the whole region (British and Portuguese) between the Zambesi and the Limpopo.

The wealth of evidence brought forward by Messrs. Hall and Neal in support of this conclusion will be received by most readers as a positive revelation, and will have all the more cogency since it is not advanced to serve a purpose, but simply as the result of long and intelligent investigation on the spot. There is no formal discussion of the problems involved; speculation is especially eschewed; and even the main conclusion itself is not stated dogmatically, but rather left to be indirectly inferred from the vast body of facts brought together with rare patience and industry in this first, but by no means final, comprehensive survey of "the ancient ruins of Rhodesia." At the same time, judicious criticism is everywhere apparent. Indeed, the whole work of research has been conducted in a thoroughly critical spirit, and the value of the book is greatly enhanced by the extremely careful and cautious way the various groups of ruins are classed in periods, types, and sequences; the earliest remains (Himyaritic or South Arabian) being distinguished from the later (Phœnician and perhaps post-Mohammedan) and recent (native and Portuguese).

As the readers of the *Journal* are well aware, this region, since the re-discovery of the "Zimbabyes" some three decades ago, had been partly surveyed by several distinguished savants and trained archæologists, notably Mauch, Baines, Bent, Swan, Maund, Schlichter, and White. Hence it might be supposed that little was left to be done by later investigations. But so vast is the field, where upwards of five hundred ruined sites are scattered over a total area of about 115,000 square miles, that the surface had scarcely been more than scratched when Messrs. Neal and Johnson, armed by the Chartered Company with the right of investigating the ruins south of the Zambezi, began their systematic researches in May, 1895, and continued them with little interruption till the close of the century. Their forerunners had, in fact, mostly trodden the beaten path, confining themselves mainly to the "Great Zimbabye" and surrounding district. "The total number of distinct and separate ruins described in their books does not nearly exceed fifty, while many of these are ruins of minor importance, and belong to the later Zimbabye periods." From this some idea may be formed of the vast amount of work accomplished by our authors, who have personally explored and given summary descriptions of no less than two hundred ruined sites—temples, citadels, ramparts, gold-workings, forts, slave-pits—mostly of the early periods, scattered over nearly the whole region. They have further conferred an inestimable service on students by their careful planning of the sites themselves, as clearly shown on the excellent large-scale map accompanying the volume.

The subject is far too vast to attempt any detailed account of the monuments and their contents. It must suffice to say that the general impression conveyed is astounding, and the astonishment is intensified when we read that even now an immense amount of work remains still to be accomplished. This is continually

insisted upon and convincingly proved by the writers, as when they tell us that the Khami ruins, nearly as important as the Great Zimbabye itself, "are practically unexplored. The temple is still buried under the present floors. The original floors are not opened out, nor are the floors on which the gold-smelting furnaces will in all probability be found" (p. 225). And again: "Not a single ruin notwithstanding months of continuous work, can be said to have been exhaustively examined, while many ruins are altogether unexplored, and others are constantly being discovered" (xii.).

If, after a careful study of 'Rhodesia' and 'Ophir,' any lingering doubts should remain regarding the Himyaritic origin of the South African ruins, they will probably be dispelled by a consideration of the character and prodigious development of the ancient terrace-works on the slopes of the Mount Fura and Inyanga uplands in North Mashonaland. Nothing comparable to this arduous agricultural system is elsewhere found, except in the Peru of the Incas, which is beside the question, and in the Sabæan and Minæan highlands of Arabia Felix (Yemen), where the corresponding works, although the parallelism has hitherto passed unnoticed, are not merely analogous, but absolutely identical, both in their general aspect and enormous extent. So true is this that the descriptions given by independent observers of the terraced slopes in both regions might almost change places, as may be seen by comparing the two subjoined accounts:—

Terraced Slopes
(*Yemen*).

"In one district the whole mountain-side, for a height of 6000 feet, was terraced from top to bottom. Everywhere, above, below, and all around, endless flights of terraced walls meet the eye. One can hardly realize the enormous amount of labour, toil, and perseverance which these represent. The terraced walls are usually from 4 to 5 feet in height, but towards the top of the mountain they are sometimes as much as 15 or 18 feet. They are built entirely of rough stone laid without mortar. I reckoned on an average that each wall retains a terrace not more than twice its own height in width, and I do not think I saw a single breach in one of them unrepaired" (General E. T. Haig, *Proceedings* Geographical Society, 1887, p. 482).

Terraced Slopes
(*Inyanga*).

"The extent of these ancient terraces is simply astonishing, and there is every evidence of the past existence of hundreds of thousands of inhabitants. It would be quite impossible to convey any adequate idea of the immensity of labour implied in the enormous number of these ancient terraces. I saw at least 150 square miles composed of kopjes from 100 to 400 feet in height literally strewn with the ruins. A contemplation of the enormous tonnage of stones and earth rudely built into these terraces really left me amazed. Goodness only knows how many thousands of these terraces I did not see. It appears to be abundantly clear that the terraces were for the purpose of cultivating corn or cereals of some sort. The terraces as a rule rise up in vertical lifts of about 2 or 3 feet, and extend backwards over a distance of mostly about 7 to 12 feet. The terraces are all made very flat and of dry masonry, not of hewn stone. On many of the kopjes, commencing at the base, there are, I judge, one hundred terraces before you get to the top" (Telford Edwards, quoted in 'Rhodesia,' p. 353 *sq.*).

The late Dr. Schlichter had already pointed out that the terraces were "pre-Mohammedan." Consequently they fall into line with the other remains credited beyond reasonable doubt to the South Arabian Himyarites and their Phœnician cousins, whose long sojourn in the neighbouring island of Madagascar is introduced as a new factor in the problem by the author of 'The Gold of Ophir.'

Although keeping as a rule closely to their text, the authors of 'Rhodesia' have occasionally permitted themselves a short excursion into other fields, which might perhaps be omitted with advantage in future editions, or else subjected to careful revision. Thus the "Moguedchou kingdom north of Sofala" should be Magdoxo, Somaliland; the first home of the Sabæo-Arabians was not in "Caldæa," but unquestionably in Arabia Felix; Marseilles (Massilia) was not a "Phœnician," but a Greek colony; "Durato" and "Durate" should be *Duarte* (Barbosa); Ptolemy (the geographer) did not write "about 200 B.C.," but in the second century of the new era; Zenophon is, of course, a misprint for Xenophon; but the suggested association of the Sabæan goddess *Almaquah* with "the name of Namaqualand," and one or two other strange etymologies, should be carefully eliminated.

GENERAL.

Beazley's 'Dawn of Modern Geography.' *

The first instalment of this fascinating work dealt with what Mr. Beazley describes as the "Dark Age" of geography. He now passes on to the Central Middle Ages. Down to the close of the ninth century Europe had scarcely a glimpse of that marvellous "Dawn" which was destined to illuminate the globe, although the discoveries and conquests of the Northmen had already begun, and these intrepid seamen were not only infesting the coasts of Western Europe, but had settled in Ireland, discovered the Hebrides, the Shetlands, the Orkneys, reached the great island of Iceland, and made their way to Greenland in the west, where they were, in fact, on American soil, and to the neighbourhood of Archangel in the east. Already they had overstepped the limits of the world known to Ptolemy. Yet these voyages produced no change in current geographical ideas; and even that most extraordinary episode in the maritime history of the middle ages—the Norse discovery of the American continent and the exploration of its coasts as far south as New England—passed without leaving more than the faintest of traces on the European mind. One more island had been added to the map of the northern ocean, and that was all. The impulses which produced the geographical revolution arose in another quarter, and moved in the opposite direction. Western Europe directed its attention with ever-increasing interest and persistence to the East, and multiplied its relations with Asia through many channels. Most of the present volume is occupied in tracing the progress of this growing intercommunication under the several forms of Pilgrim Travel, Jewish Travel, Diplomatic and Missionary Travel, and Commercial Travel.

Pilgrim travel, considered as a means of promoting geographical knowledge, had comparatively little importance until the capture of Palestine by the crusaders. It is true that a change appears with the turn of the century after A.D. 1000, when pilgrims began to be much more numerous, and the threatened interruption of the means of access to the holy places served as a pretext for the ferment which

* 'The Dawn of Modern Geography.' Part ii. A History of Exploration and Geographical Science from the Close of the Ninth to the Middle of the Thirteenth Century. By C. Raymond Beazley, M.A., F.R.G.S., Fellow of Merton College, Oxford. London: John Murray. 1901.

culminated in the first crusade. But the great influx of pilgrims began with the establishment of the Frankish kingdom of Jerusalem. Among these Saewulf of Worcester, Abbot Daniel of Kiev, Adelard of Bath, and the Norse King Sigurd are noteworthy, although the pilgrim, as such, contributed little or nothing to the actual stock of geographical information, and the conquest of the holy places was chiefly important as affording a stepping-stone in the direction of the remoter East. Jewish travel in the East assumed a wider scope, both in the ground actually covered and in the objects pursued by it. The interest of the Jew extended far beyond the Holy Land. It embraced Syria, Mesopotamia, and the tombs of Ezekiel and Daniel, the prophets of the Captivity who were still honoured by the Moslems; it impelled him to seek out and maintain communication for commercial purposes with those of his race who were settled in Persia. The Jewish merchant, Benjamin of Tudela, reached the head of the Persian gulf, and his well-known narrative familiarized Europe with the sea-route to Ceylon and China. He was followed by Petachia of Ratisbon and others of less note, whose journeys Mr. Beazley passes over lightly, and proceeds to discuss the more important travels of the missionaries and diplomatists who, in the thirteenth century, penetrated Central Asia with the view of conciliating the Mongol hordes who threatened Europe. Two of these, Carpini, who went as the Pope's legate, and Rubruquis, an emissary of King Louis IX. of France, have left accounts of their adventures which rank among the most important documents of geographical history. Rubruquis, starting eight years later than Carpini, travelled by way of the Black sea, crossed the Volga and the Ural mountains, reached the Great Khan's court, and brought back an immense store of information about the geography of Central Asia and China, and the customs, languages, and religions of their inhabitants. The report had gone forth in Europe that the Tartars were little attached to their primitive idolatry, and not favourably disposed towards Buddhism and Mohammedanism. Rubruquis found Nestorians and Armenians hanging about the Khan's court, promising him the dominion of the world if he embraced Christianity. The impression they had produced was a bad one, and Rubruquis was unable to improve it. He brought back to Louis, whom the Great Khan regarded as a prospective vassal anxious to secure his favour, a rambling letter, breathing nothing but a haughty and fanatical sense of his own power, and of the superiority of the Tartars to all other races on the globe. The mission was a failure, but Rubruquis had done something to bridge the gulf between the West and the far East, and to prepare the way for travellers like Marco Polo, whose descriptions, at a later date, made Tartary, China, and the Eastern islands almost as familiar to Europeans as Europe itself.

The chapter on Commercial Travel deals with the mercantile enterprise carried on with the East by Constantinople and the great maritime republics of Italy, especially during the crusading period. So long as they lasted, the Christian states, established by the crusaders in the Levant, formed new bases for Western trade, while they seriously impeded Moslem intercourse between East and West. The kingdom of Jerusalem commanded the land routes connecting Egypt and Africa with Western Asia. With Petra in the desert, and Elath on the Red Sea, in Christian hands, the produce of India and the far East found its way easily to the European merchant, while the markets of Aleppo and Damascus, Mosul and Bagdad, were rendered more accessible. Even after the principalities of Jerusalem, Antioch, Edessa, and Tripoli had fallen into decay, European enterprise was actively pushing its way farther and farther into Asiatic lands. But with their complete extinction, says Mr. Beazley, "the old difficulty of a hostile and almost impenetrable Islam once more confronted the European nations along the coast-

line of Syria." If not a direct cause, this state of things at least indirectly contributed to the shifting of maritime enterprise to the other end of the Mediterranean, and to schemes for reaching India and the farther East by sailing out through the strait of Gibraltar. Mr. Beazley's concluding chapter deals with geographical theory and description during the central middle age. Foremost among the geographers of the time stands the emperor Constantine Porphyrogennetos, whose treatise 'On the Public Administration of the Empire' not only minutely describes the empire itself with its vassal states, but abounds in information about the barbarian regions to the north and east. After devoting nearly fifty pages to an analysis of this extremely interesting document, Mr. Beazley passes on to Adam of Bremen, the first pioneer in the long series of German geographers, and concludes his volume with an examination of the extant maps of the period, the oldest of which, the 'Anglo-Saxon' Map of the World, drawn by an Irish monk, and now in the British Museum, he attributes to the time of Archbishop Sigeric of Canterbury (992-994). The photographic facsimiles of this, and of the sixteen other contemporary maps, including four maps by Matthew Paris—the 'England,' the 'World Map,' the 'Itinerary,' and the 'Palestine'—will furnish an abundant feast to the numerous amateurs of historical cartography.

E. J. Payne.

Prof. Ratzel's Comparative Geography.*

The scope and bearing of Prof. Ratzel's new book cannot be fully understood from the first volume. In the preface he refers to it as a "Comparative Geography" in Ritter's sense of the term, dealing, that is to say, with the interrelations of the phenomena of the Earth, and therefore looking at the general rather than the special aspect of geography. The work is not a student's text-book like Wagner's 'Lehrbuch'; it partakes rather of the character of Reclus' 'La Terre,' being written apparently for the intelligent general reader sufficiently interested in the subject to attack a considerable mass of printed matter, but not requiring the aid of frequent references to authorities. In fact, at the first inspection, 'Die Erde und das Leben' shows a freedom from footnotes that would be surprising did the preface not promise a list of works consulted in the second volume.

The portion of the work now before us gives a brief but luminous summary of the history of geography, turning over the familiar facts with the ease and freshness that only a specialist leading up to his special study can command. Then follows an account of the Earth as a planet and as a physical body, succeeded by chapters on volcanic phenomena, the movements of the Earth's crust, and the origin of mountains. The remaining two-thirds of the volume are devoted to what we may call physical geography in the particular meaning of the word.

Land and water, islands, coast-lines, geological processes, and land-forms are handled with an absence of technicality and a literary grace that we do not always find in German geographical works, but there is no want of precision as to facts. In discussing the various features, reference is made in many cases to their influence on human movements and the broader human interests which unite all intellectual studies are not forgotten. This aspect of the subject will be developed more fully in the second volume, which will deal with the oceans and the atmosphere, and culminate in Prof. Ratzel's special sphere of Life and Man.

The illustrations are very numerous and almost all strikingly good, the clear sketch-maps as well as the photographs. A series of coloured plates is an attractive

* 'Die Erde und das Leben.' Eine vergleichende Erdkunde von Prof. Dr. Friedrich Ratzel. Erster Band. Leipzig und Wien: Bibliographisches Institut. 1901.

feature, and so is the simple but beautiful design of the binding. We trust that the second volume will be provided with a full index, and we venture to hint that the list of works consulted might be more carefully considered from the points of view of selection and arrangement than that given on p. 66.

H. R. M.

THE MONTHLY RECORD.

EUROPE.

Ingleborough.—Few maps of the Ordnance Survey show more interesting features than Nos. 50 and 60 of the Hawes and Settle districts. Prof. Hughes of Cambridge has a valuable account of the physical geography of the Ingleborough neighbourhood in the *Proceedings of the Yorkshire Geological and Polytechnical Society* (vol. xiv. pp. 125–150). He says that he knows of no district in which the ordinary and exceptional operations of denudation can be better studied. It illustrates remarkably the effects of "the condensation of the moisture of the winds on the cold rocks working where no rain can reach; the action of water more or less charged with acids on the limestones; the fantastic forms which are thus produced; the effect of this action on a larger scale in the formation of pot-holes and of underground channels and of valleys by the falling in of caves; the breaking-up of great masses of jointed rock under the influence of frost and the masses that in the thaw are carried over the frozen snow that fills the place where the talus should rest, and form crescentic masses lying some way in front of the cliff; the cutting back of gorges by the removal of block after block, first detached by complex denudation, then lifted out of their bed by the hydrostatic paradox and hurled over the edges of the cliff."

The Cheddar Gorge.—In the February number of the *Geological Magazine*, Dr. C. Callaway calls attention to the zigzag course of the Cheddar gorge as almost certainly due to the jointing of the carboniferous limestone through which the river there flows. This is traversed by two systems of joints, apparently nearly vertical, and intersecting approximately at a right angle, the stone readily breaking away, when quarried, in cubical blocks. That the course of the gorge is due to these joints is supported by the fact that the marked zigzags cease at the end of the gorge, just where the limestone gives place to the Trias, in spite of the more gradual fall in the river-bed during its passage across the latter formation. Dr. Callaway shows that the explanation will hold equally well whether the gorge is supposed to have been cut by a stream flowing above ground or below the surface, though he inclines to the latter view of its mode of origin.

Rainfall Maps of Brandenburg and Pomerania.—The most recent addition to Prof. Hellman's series of rainfall maps of northern Germany, which makes a gradual progress westward from the extreme east, includes the provinces of Brandenburg and Pomerania. The map shows the average rainfall for the ten years 1891 to 1900, a period which comparison with the long-period average of a few stations within the area shows to approximate very closely to the mean. Speaking generally, the greatest amount of rainfall is recorded on the eastern, southern, and western boundaries of the district represented, while the smallest occurs near the middle, in the valley of the Oder. The short paper which accompanies the map deals chiefly with the variations of yearly amounts from the mean, and with the frequency of occurrence of heavy falls of rain. It appears that the average rate of fall per minute is twice as great for showers lasting under an hour, and four times as great for showers lasting less than a quarter of an hour, than for steady rain lasting over three hours. The map is based on the records

of one hundred and eighty stations, employing gauges of 200 square centimetres' area, placed one metre above the ground.

The Limits of the Visibility of Land in the Mediterranean.—It has lately been pointed out by Dr. L. Henkel in a short article in *Petermanns Mitteilungen* (1901, No. 12), that, apart from the nautical charts which show the limits of visibility at sea of the various forms of warning lights, no attempt has yet been made at a cartographical representation of such limits of visibility in the case of ordinary landmarks, in spite of the acknowledged influence which the presence or absence of land-masses visible to a great distance must have exercised on the early history of navigation. As a step in this direction, he has constructed an interesting map of the Mediterranean, on which the water-areas from the surface of which no land can be seen are shown by a distinctive tint. The main factor in the question is, of course, the altitude of the principal mountains adjacent to the coast-lines of the sea in question, and Dr. Henkel begins by drawing up a table of these. Where information as to the altitude of the coast-lines is wanting or imperfect, as in the case of Tripoli, he has been forced to depend upon rough estimates. One unbroken area out of sight of land occupies the southern part of the Eastern Mediterranean from the Little Syrtis to beyond the delta of the Nile, while smaller areas occur in the Sardinian, Tyrrhenian, and Black seas, and even in the Sea of Azov. Owing to the generally high altitude of the South European lands, the limit of visibility is pushed a long way south of their coast-lines, and neither in the Ægean nor the Adriatic is there any point from which some land cannot be seen. On the other hand, the limit runs much closer to the African coast, especially in the eastern half.

ASIA.

Dr. Sven Hedin's Journey across Tibet.—Letters received in Sweden from Dr. Hedin, including one addressed to King Oscar and published in the Stockholm *Dagblad* for January 31 last, give some further details of the explorer's march across Tibet during the latter half of 1901, and his unsuccessful attempt to reach Lhasa disguised as a Buriat pilgrim. It will be remembered that Dr. Hedin left Charklik, south of Lob Nor, in May of last year, intending to cross Tibet in a diagonal direction to the neighbourhood of the sources of the Indus. His caravan consisted of thirty-nine camels and about an equal number of horses and mules, besides donkeys, sheep, etc. Besides the four Cossacks of his escort, his party included a Mongol lama and twenty-four others, mostly inhabitants of the Lob Nor region. Crossing the Arka (Akka) Tag and other high ranges, Dr. Hedin arrived within fourteen days' journey of Lhasa, and then, leaving the bulk of his caravan, which had already dwindled considerably in size, pushed on (July 27) with the lama above mentioned, and a Buriat, in the direction of the sacred city. The small party was attacked by robbers during the first night, and several of the best horses were stolen, so that it was found necessary to keep a constant watch, each of the three members of the party taking his turn in succession. On the eighth day Dr. Hedin was stopped by Tibetan horsemen, and a few days later received a visit from the governor of the province, who firmly vetoed the attempt to visit Lhasa, but was in other respects friendly, causing the stolen horses to be restored. Towards the end of August the small party regained the camp in which the caravan had been left, and the march was resumed in a direction somewhat west of south, which brought the party to Lake Nakchang-tso.* A force of

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* The north-west portion of Lake Garing, or Gyaring (Zilling of Littledale), in 89° E., is called by Bower Naksung-Satu. According to Grenard, the Tibetan department of Nagchang extends from about 86° to 88° 30′ E., while a district "Nakchang" is placed by Mr. Littledale between 85° and 86° E.

Tibetans was again encountered, which dogged the travellers' footsteps in order to prevent any renewed attempt in the direction of Lhasa, and only took its departure when the caravan was well on its way to Ladak. As already recorded, this was finally reached in the middle of December last.

The Aral Sea.—The interesting periodicity of changes of level in this lake, which was revealed by the last Aral expedition of L. S. Berg, has already been mentioned in these pages. During the years 1848-1880 the level of the lake was undoubtedly sinking, and the rate of desiccation was estimated by Dorandt, in 1875, at nearly 3 inches each year. However, it appears from L. S. Berg's explorations that since 1880 the level of the lake has been rising, the total rise being about 7 feet (2·05 metres) for the last ten years. A similar rise of level has been noticed, for the last twenty years, in Lakes Tenis and Kurgaljin, situated 530 miles north-east of Lake Aral, and in Lakes Denghiz, Teke, and Kyzyl, 270 miles north-east of Aral, since 1894–95. In an article published in *Petermanns Mitteilungen*, to which reference was made in the *Journal* for November last (p. 531), Prof. Woeikoff showed that the above changes of level are very well explained by the variations in the annual quantity of precipitation, such as appear from meteorological observations made at Barnaul, in West Siberia, where we have the longest series of pluviometric observations in Asia, for the last sixty-two years. Woeikoff's averages run as follows:—

	Millimetres.	Inches.		Millimetres.	Inches.
1838–42	332	15·04	1873–77	280	11·02
1843–47	275	10·83	1878–82	380	14·96
1848–52	254	10·00	1883–87	441	17·36
1853–57	213	8·39	1888–92	489	19·25
1858–62	165	6·50	1893–97	451	17·76
1863–67	138	5·43	1898–99	484	19·05
1868–72	223	8·78			

It appears from these figures that the fluctuations in the precipitation are very considerable, and that the maximum quinquennial average is nearly two and a half times greater than the corresponding minimum. There is also a marked periodicity, the length of the period being probably about fifty-five years. We now learn from a communication made by General Gedeonoff to the Turkestan Geographical Society at Tashkend in December last, that the same periodicity in the precipitation is apparent in the observations made at Tashkend since 1872, as may be seen from the following figures:—

	Millimetres.	Inches.		Millimetres.	Inches.
1872	194	7·64	1888–92	361	14·21
1874–77	242	9·55	1893–97	381	15·00
1878–82	342	13·46	1896–900	389	15·31
1883–87	325	12·79			

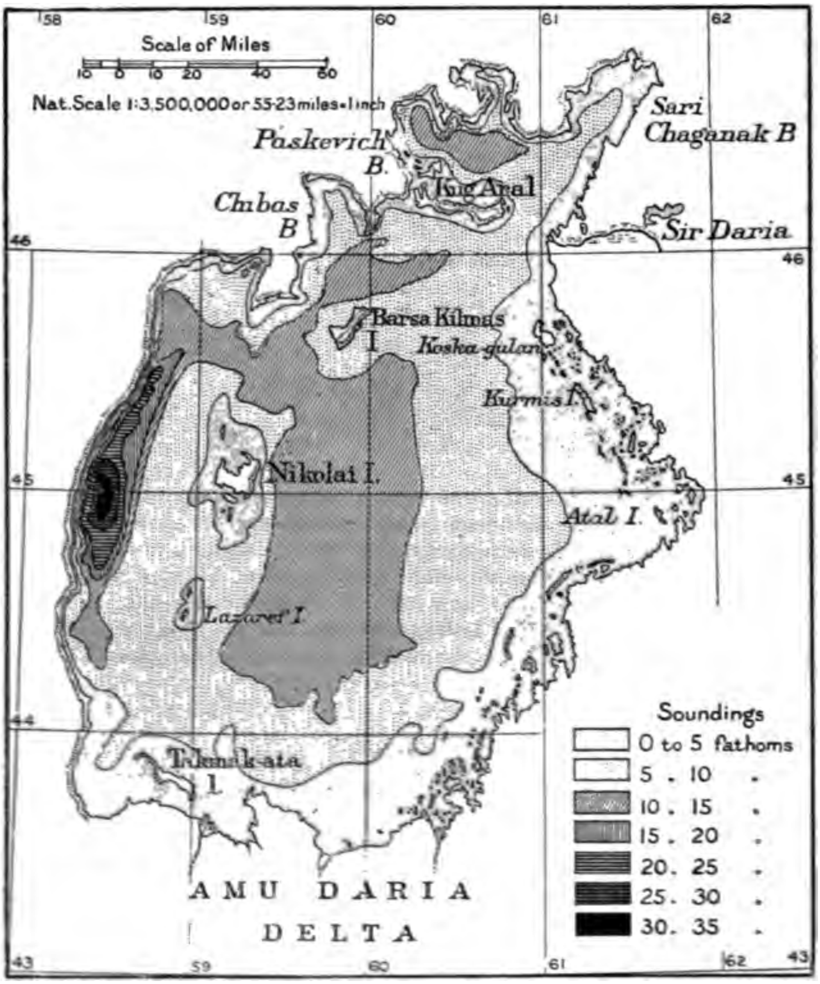
The oscillations are thus analogous to those noticed at Barnaul. It must also be remarked that the oscillations in the levels of the lakes seem to be fifteen years behind the oscillations in the precipitation. The communication made to the same society by L. S. Berg about his work in 1901, on board the yacht *Orion*, was most interesting. The fact that he found the geodetic mark made by Tillo in 1874, and that this mark was now 1·21 metre lower than it was then above the level of the lake, has already been mentioned in these pages. Berg's observations on the changes of temperature and salinity will, we hope, be continued. The specimens of the plankton which he collected have been studied by Prof. Zernoff, who has found among them quite a number of species which have lately been

found by Sars as characteristic of the Caspian fauna. Such are the Cladoceræ: *Cercopagis tenera, Evadne producta, E. anonyx, E. camptonyx,* and the Crustacean *Diaptomus salinus.* Dredging has, as in previous years, brought up only the following well-known forms: *Cardium edule,* two species of *Dreyssena, Adacna vitrea,*

ARAL SEA.

Hydrographical data from the surveys by Berg and Molchanoff.

1900.



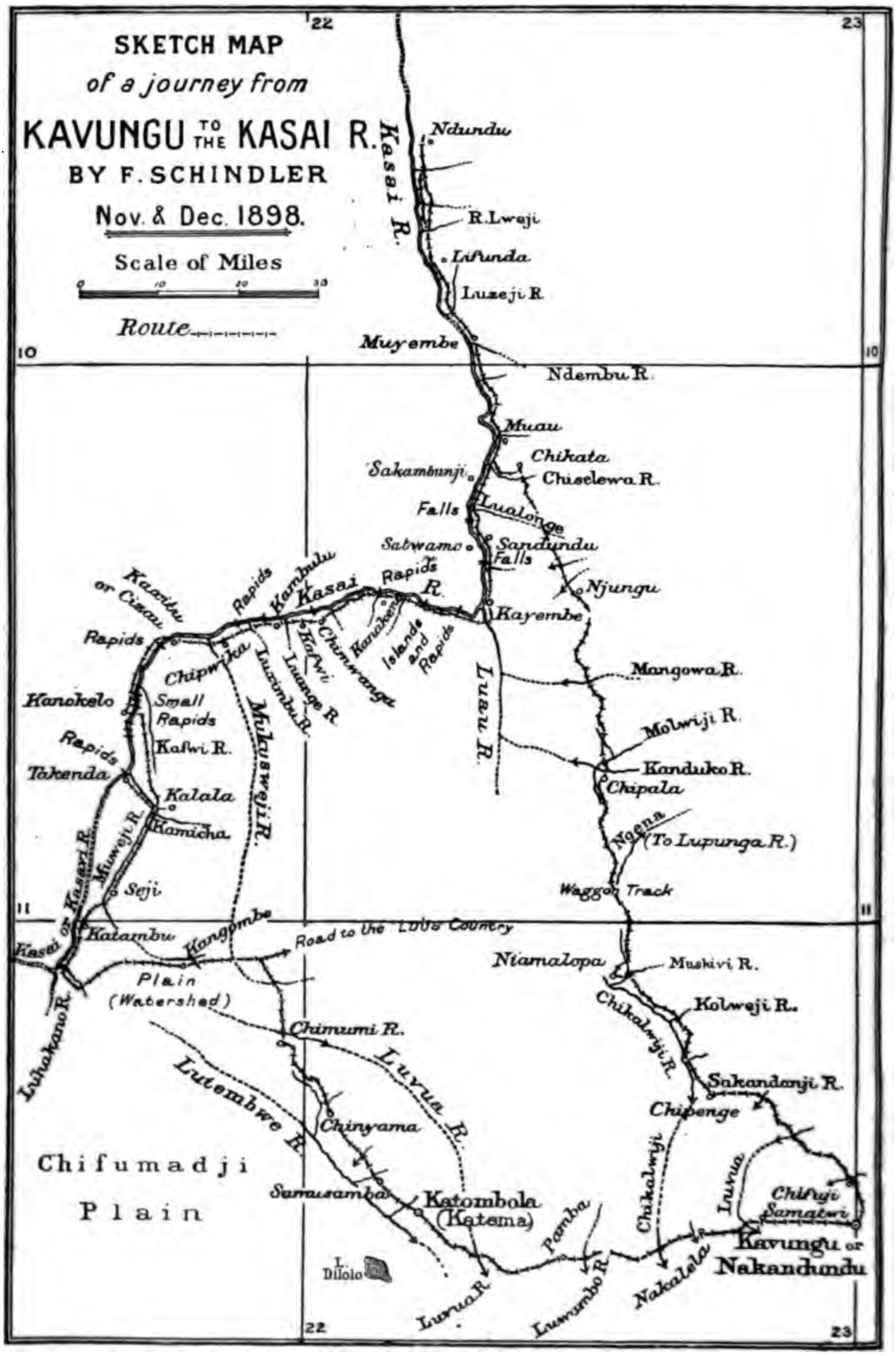
Hydrobia stagnalis, two species of *Gammarus,* and larvæ of both *Chironomus* and an Oligochetes worm. Large collections of plants, as also of specimens of termites, two new species of lizards and snakes, and so on, were made, and the society has decided to continue the exploration during the coming summer as well. The results

of the hydrological observations of Berg's expedition, as also of Molchanoff's survey of 1900 at the mouth of the Syr, are embodied in the accompanying map, which is a reduced copy of the map published at Tashkend, on the scale of 17 miles to the inch.

AFRICA.

The Upper Kasai.—The accompanying sketch-map (see next page) is based on a route-survey with prismatic compass carried out in 1898 by Mr. F. Schindler, one of the missionaries who have been at work for the last fifteen years in the interior of West Central Africa. It adds somewhat to our knowledge of the upper course of the Kasai, which has generally been crossed at right angles by travellers in this region, and has rarely been followed for any long distance from south to north. It will be seen that the course of the river in this section differs considerably from that shown on existing maps, especially in the two sharp elbows, with a west-to-east stretch between them, which occur in about 10° S. Mr. Schindler's journey, which was undertaken mainly with a view to testing the navigability of the Kasai in this section, was made in the rainy season, and the difficulties of the march were much increased on this account, various parts of the country being flooded at the time; much difficulty was also experienced in obtaining porters. From Kavungu or Nakandundu (Nana Kundundu of Arnot and others) the route lay west to the village Katombola, the successor of the Katema visited by Livingstone and Arnot, and thence north-west parallel to the Lotembwe to the trade route from Bihe to the Luba country. The Kasai was struck at the bend a little south of 11°, where it is joined by the Lubakano from the Chifumaji flat. Two rapids were reported higher up the river, at one of which, near Muhumbo, the rocks are said to form a natural bridge. The river was soon left for a time, as there were said to be no villages on its banks. Except at Kangombe, on the Bihe trade route, population had been sparse since leaving the Lotembwe; but on the Muweji, a tributary of the Kasai, there was a fairly dense population of three distinct tribes—the Va-Mbunda or Va-Luenu, the Va-Chiyoko or Va-Chibokwe, and the Va-Lunda, each speaking its own dialect. Further on, too, villages were frequently met with along the Kasai, though often placed at a little distance from the actual bank of the river, so that the paths which join them are not close to the water. Towards the north the villages were generally larger than those of the Va-Lovale. There was little demand in these regions for anything but salt, of which there is great scarcity, as the Bihe caravans do not pass this way. The Kasai was much broken by rocks and rapids, rendering navigation impossible for the most part. It gradually increased in width, sometimes containing islands, and its well-wooded valley at times presented a lovely sight. The Luau and Ndembu rivers, which enter the Kasai on the right, had both to be crossed in boats. A little below the mouth of the former are the Sandundu falls, visited by Captain Lemaire. In about 10 10′ S., the village of Sakambunji, which has figured on our maps since the date of Graça's journey in 1843, was seen on the opposite bank, and some distance lower down, Lifunda or Difunda, the crossing-place of Pogge in 1876, was passed. The lowest point reached was the village of Ndundu, whence Mr. Schindler was forced to turn back, as his followers were frightened by reports of a war camp of the Va-chibokwe—great slave-raiders—two days ahead. The return journey to Nakandundu was made by an almost direct route, leaving the Kasai near Sakambunji.

Positions fixed by the Marchand Expedition.—In a series of articles lately published in *La Géographie*, Naval-Lieut. A. H. Dyé gives an elaborate discussion of the methods and results of the astronomical observations taken by himself and M. Germain during the course of the Marchand Expedition across Africa. An unusual amount of care and attention was devoted to these observations,



SKETCH MAP
of a journey from
KAVUNGU TO THE KASAI R.
BY F. SCHINDLER
Nov. & Dec. 1898.
Scale of Miles
0
10
20
30
Route
22
23
10
11
Kasai R.
Ndundu
R. Lweji
Lifunda
Luzeji R.
Muyembe
Ndembu R.
Muau
Chikata
Chiselewa R.
Sakambunji
Falls
Lualonge
Satwamo
Sandundu
Falls
Njungu
Kayembe
Rapids
R.
Kasai
Kambulu
Rapids
Kasaibu or Cizau
Rapids
Chipwika
Kanakeni
Islands and Rapids
Chimwanga
Kafwi
Luange R.
Lucimbu R.
Luau R.
Mangowa R.
Molwiji R.
Kanduko R.
Chipala
Ngena
(To Lupunga R.)
Waggon Track
Kanokelo
Small Rapids
Kafwi R.
Rapids
Takenda
Kalala
Kamicha
Mukuisweji R.
Muweji R.
Kasayi R.
Seji
Katambu
Kasai or
Kangombe
Road to the Lubo Country
Niamalopa
Mushivi R.
Plain (Watershed)
Luhakano R.
Chimumi R.
Chikalwaji R.
Kolweji R.
Sakandanji R.
Luvua R.
Lutembwe R.
Chinyama
Chipenge
Chifumadji Plain
Samusamba
Katombola (Katema)
Chikalwaji
Luvua
Chifugi
Samatwi
Kavungu or Nakandundu
Pamba
Luvua R.
Luwumbo R.
Nakalala
L. Dilolo

and the results are of much importance for the mapping of the section of tropical Africa traversed by the expedition. The writer discusses in turn the general question of the most suitable instruments for such observations and their mode of use, the elimination of the errors of the instruments, and the special methods adopted for the determination of latitudes, of the local time and its transport from place to place, and of Paris time by occultations of stars by the moon, and other less exact procedures, the relative accuracy to be expected from each being clearly brought out. The value of the results is thus greatly enhanced by the facilities given for checking the precision of any particular value. The section dealing with the determination of longitudes is naturally that of most interest. Owing to the rare occasions on which the method of occultations could be employed, all the stations within a given region were as far as possible connected by the transport of local time, which, as the writer points out, gives specially good results during river voyages; while certain points in each region were fixed by absolute methods. Thus, on the upper Ubangi, the difference of longitude between all the important stations was fixed by the transport of time in closed circuits, while the absolute longitude of Mobaye and Wango was fixed by occultations. Other groups of positions treated in the same way were those of the Mbomu, the Swe, the Bahr-el-Ghazal, Nile and Sobat, and Abyssinia, the principal station in the last-named being Addis Abbaba, the longitude of which, as already made known, was found to be 36° 24′ 10″ E. of Greenwich. The table given by Lieut. Dyé includes about seventy-five positions, the fixing of which involved the observation of more than 2250 altitudes of the sun and stars, or an average of thirty for each station.

The Past History of Tanganyika.—In the last number of *Petermanns Mitteilungen* for 1901, Dr. Ernst Stromer discusses the question, as to which so many divergent views have already been expressed, whether we are justified in concluding that Tanganyika represents an old arm of the sea—a "Relikten-see," according to the German terminology. While hesitating to express a decided opinion as to the past history of the lake, he holds that Mr. Moore's view—based on the halolimnic fauna brought to light within recent years—that it is a remnant of an old arm of the sea which, in Jurassic times, reached from the west to the very centre of the continent, is not supported by geological facts, and is, besides, open to other objections. After summarizing our present knowledge of the sedimentary formations of Central Africa, he shows that, while in Jurassic times a considerable part of the East African coast-lands was covered by the sea, there is absolutely no evidence that such was the case in West Africa, either on the coast or in the interior, while the Jurassic period is just that in which Neumayer has supposed a land connection between Africa and South America to have existed. He considers it unlikely that the great change of conditions which must have followed a separation of Tanganyika from the sea and the gradual freshening of its waters should have failed to change the character of the halolimnic organisms, and is inclined to regard these rather as an instance of convergent development, such as has been considered possible in the case of other widely separated forms of life. The freshwater forms in Tanganyika may, he considers, be the result of a recent immigration, it being not improbable that the lake remained quite isolated from other waters of Central Africa until recent times.

Egyptian Irrigation and Surveys in 1900.—Sir William Garstin's annual report for 1900 on the Egyptian Public Works Department contains, as usual, full details of the progress made during the year in matters connected with the irrigation service, including the works on the great dams at Assuan and Assiut, as well as in the operations of the Survey Department. The opening section deals with the Nile supply in 1900, which disputes with that of 1899 the distinction of being

the worst on record. During the early summer the situation was extremely critical; but though temporary relief was afforded by the sudd-cutting operations, which set free some of the water held back on the upper Nile, and by an early rise derived from the Blue Nile and Sobat, the flood as a whole remained an exceedingly poor one, little or no supply being received from the upper Nile region, where the rainfall had been extremely scanty. That the difficulties arising from a practical failure of supply in two successive years were successfully coped with is greatly to the credit of the Irrigation Department. As regards the surveys executed in 1900, under the superintendence of Captain Lyons, we are told that the minor triangulation of the Fayum was completed, together with a considerable proportion of the major triangulation in the provinces of Dakahlia and Kaliubia, where the minor triangulation was also commenced at three points. In Menufiyeh province the theodolite traverse for the main portion of the chain survey was completed. Good progress was made with the revenue surveys, while the principal work done by the staff of the Geological Survey was the compilation of the results of the field work carried out in previous years, and preparing them for publication. A commencement was made with the survey of the Cataract region, south of Wadi Halfa, which is estimated to require three years for its completion. A trial boring for water at Kafr Dawar, with a view to the possible supply of Alexandria from a subterranean source, gave no satisfactory results. The Meteorological Department has steadily extended its operations, and results of much practical value have been obtained. During the year the heavy work on the new Egyptological Museum was completed, and it was hoped that the transfer from the existing museum at Gizeh would be carried out early in the present year.

AMERICA.

Proposed Relief-model of the United States.—We learn from the New York *Evening Post* of March 12 last, that a project has been set on foot in Washington for the construction of a model of the United States on the scale of 1 : 25,000. This is not the first time that the idea of such a model has been mooted, for several years ago a scheme was under consideration for the construction of an out-of-door model on the Potomac flats. It has been urged, however, that the coarseness of workmanship required to render the model proof against climatic influences would detract from its value. It is therefore proposed to place the model in a low but well-lighted building, some 800 feet long, and half as much wide, and it is thought that the scale mentioned, which corresponds with one of about 2½ inches to the mile, would permit the representation, not only of the relief of the country in true proportion, but of natural features, such as forests, swamps, watercourses, etc., as well as the products of human activity, such as highways, bridges, railways, buildings, etc. To facilitate the keeping of the model up to date, the whole would be divided into sections of standard size, any of which might be corrected or replaced when necessary, and it is also suggested that duplicates of the sections might be sold for educational purposes. The project has not yet advanced beyond the embryo stage, but there can be no doubt that, if carried out, the result would be most interesting and instructive.

Changes in the Mississippi Flood-level.—In an appendix to the voluminous report of the Mississippi River Commission, issued annually in the Report of the Chief of Engineers, U.S. Army, Major G. M. Derby discusses the question of certain changes in flood-heights in the Fourth river district, making interesting deductions as to the precise way in which engineering operations have affected the flow of the river. He points out that, while the study of the relations of gauge-heights is apt to be unsatisfactory owing to the number of variables in the problem, there is a certain

stretch on the lower Mississippi which presents exceptional facilities for investigation. This is the 200-mile interval between the mouth of the Red river and New Orleans, which is practically free both from the influence of tide (felt at the next gauge below New Orleans) and from disturbances due to tributaries or outlets. During the flood of 1897, which broke the high-water record at every gauge in the district, Major Derby was surprised to find that the first gauge to exceed its record was the lowest (that at Fort Jackson), the next that at Carollton, and so on up the river to Red river landing, where the record was not exceeded until sixteen days after such had been the case at Carollton. When the Carollton gauge reached its former maximum, that at Red river landing still marked 1·6 feet below the previous greatest height. These facts were of interest as tending at first sight to show that a raising of the bed of the river had taken place at the lower stations, as has so often been claimed as a natural result of levee-building. Having shown, from observations of other flood-waves, that the phenomenon was not an isolated one, but that a progressive change in the regimen of the river has actually taken place, Major Derby considers in turn the three causes to which the change must be due. He shows that it is not a result of a filling up of the bed of the river below, for no increase in the flood-height at Carollton has been observed during minor flood-waves, where the operation of this cause would be proportionally more noticeable. Neither is the change due to the closure of crevasses by which the water formerly found an outlet, for below New Orleans none have been closed within the last thirty years which drew water from the river below a full-bank stage, at or near which it is shown that the phenomena occur. Above the Carollton gauge no low-level crevasse has been closed since 1887, since which date the change alluded to has continued to progress. The third and only remaining explanation, which must therefore be the true one, is that an increase in the carrying capacity of the river between Red river landing and Carollton has taken place, while it may be shown that this must have occurred at such a height in the bed of the river as to manifest itself only at high stages. This is corroborated by a statement in the report for 1899, according to which there has been a general tendency to a permanent enlargement of the stream above the low-water line. The practical effect of this in the section under consideration is to diminish the high-water slope, so that a flood-wave producing a given height at Carollton will now pass Red river landing at a level several feet lower than would have been the case fifteen or twenty years ago.

AUSTRALASIA.

Prof. J. W. Gregory's Expedition to Lake Eyre.—The expedition under Prof. J. W. Gregory, to which reference was made in our last number (p. 377), returned to Adelaide on January 23 after a very successful journey. An outline of the experiences of the party appears in the Adelaide *Register* for January 24. After starting from Adelaide on December 12, Prof. Gregory engaged a team of nine camels at Hergott, and proceeded along the Queensland cattle road to the Lutheran mission station at Kilalpeninna, where he and his companions were cordially welcomed. The march was resumed by way of Cooper creek to Lake Eyre, collections of fossils, including specimens of the giant kangaroo and diprotodon, being made *en route*. The fossil deposits were traced further west than the point at which they were recently seen by Mr. H. Y. L. Brown, the Government geologist, whose observations are, however, fully confirmed by Dr. Gregory. The Diamantina river was next struck (the route from Cooper creek lying across a waterless tract), and its course followed for some distance, the party then making for the Macumba across rough sandhill country, in which some difficulty was experienced in obtaining water, as the soakages were salt, and only brackish

water could be got. The Peake station was finally reached, and a moonlight march across the Denison range brought the party to Warrina station in time for the fortnightly train from Oodnadatta. Much of the country traversed had for some years been suffering from an unusual draught, but in places—as, *e.g.*, along the the Macumba—the conditions had greatly improved. Stock was, however, very scarce, and even the rabbits were nearly all dead, the ground being in many places strewn with their bones. Several storms, two of them dust-storms, were encountered. The collections made are of much interest, and particular attention was paid to the native names of plants, birds, and animals, so as to identify those mentioned in the folklore of the natives. Prof. Gregory thinks that the quasi-mythical animals spoken of by the aborigines have not been contemporaneous with man in this region.

POLAR REGIONS.

Baron Toll's Arctic Expedition.—In addition to the telegram referred to in the February number of the *Journal*, other items of news have been received at St. Petersburg from Baron Toll's Expedition, which give some idea of the work accomplished since the beginning of last summer (*Petermanns Mitteilungen*, 1902, pp. 23, 48). The *Zarya* was not released by the ice until August 25 (N.S.), when the ship drifted out of Taimyr bay into the open sea. Cape Cheliuskin, quite free from ice at the time, was doubled on September 1, and after approaching Kotelnyi island a north-east course was taken, until the ship was stopped by ice in 77° 9′ N., 140° E. On September 11 Bennett island came in sight, but ice prevented a near approach. Glaciers were, however, seen descending from the snow-clad mountains, which were traversed by deep valleys. After steaming along the ice-barrier to 77° 22′ N., 142° E., it was found necessary to return to Kotelnyi, and the *Zarya* was frozen in on September 24 in Nerpichya bay on its west coast. Here Baron Toll met the auxiliary expedition of Volossovich. During its summer cruise, the *Zarya* passed the supposed position of Sannikof Land without gaining sight of it; so that it must either lie farther north than has been supposed, or have no existence. The Nordenskiöld sea between Cape Cheliuskin and the New Siberia islands was quite free from ice, and the temperature of the water north of the Lena delta was 37°·4 Fahr. A Reuter telegram from St. Petersburg, dated March 22, announces the receipt of further news, despatched from Irkutsk on March 17. From this it is to be gathered that Baron Toll had come south to meet the mail, but that Lieut. Matthiessen had proceeded northward over the ice to study the question of the great ice-hole and its causes. The baron hoped that his supply of coal would permit of further exploration north of the New Siberia islands before returning southward up the Lena to Yakutsk.

The Geology of König Karl Land and North-East Greenland.—During his expeditions in 1898 and 1899, Prof. Nathorst made observations on the geology of these countries, with the assistance of Dr. Hamberg and Mr. J. G. Andersson (*Geol. Foren. Förhandl.*, Nos. 207, 208). König Karl Land was very fully investigated, though one or two points were left undetermined owing to a storm, which forced the party to leave the coast. The strata are almost horizontal, and the mountain-tops are covered with a layer of felspathic basalt, which has done much to preserve the islands from denudation. Erosion has, however, separated Mount Mohn on the Swedish foreland and Haarfagrehaugen on König Karl island from the adjacent plateaus, and Mount Sjögren has been cut off from Mount Tordenskjold. The south-eastern profile of Mount Nordenskiöld shows strata of sandstone tilted very slightly towards the north-east or north. The lowest beds are composed of loose white sandstone, on which lies a yellow or yellowish-brown

sandstone, while the uppermost formation is a very loose white sandstone associated with grey clay-slates. Through this last runs a layer of basalt, whether intrusive or poured over the surface before the upper beds were deposited, is uncertain. From a study of the fossils occurring in the several strata, it may be assumed that a fault runs in a northerly direction, nearly along the axis of the Swedish Foreland, and that the beds have been thrown down on the western side. The same conditions obtain on König Karl island, but there the strata have been thrown down on the *eastern* side of a fault running from Cape Altmann north-north-eastwards. The general sequence of rocks in König Karl Land is as follows: (1) Thick beds of sandstone and clay-slates without fossils; (2) Brown Jura or Dogger (Bath and Kelloway); (3) White Jura (Upper Oxfordian, Kimmeridge, and Volga); (4) Cretaceous (Neocomian). After the lower layer of the Neocomian (a marine formation) was deposited and thrown down, the sea again encroached on the land and obliterated the difference of level caused by the dislocation, so that the upper strata are deposited partly on the Dogger and partly on the Neocomian marine beds. The basalt is of Mesozoic age, as proved by microscopic examination, and by the intercalated bed containing vegetable remains. It is therefore contemporaneous with the basalt of Franz Josef Land, according to Nansen's and Koettlitz's observations. There, too, basaltic mountains predominate, overlying sedimentary strata in the south-west. At the present time there is only one glacier in the König Karl group, Kükenthal glacier on the east flank of Mount Dunér, but many signs of their former existence were noticed. Of a universal glaciation no decided proofs were obtained, and Prof. Nathorst concludes that in all probability König Karl Land was not overwhelmed by an ice-sheet from North-East Land, for rounded blocks of granite and gneiss are not found higher than about 440 feet on König Karl island, to which level or thereabouts the sea appears to have risen. Striated blocks were found only on the lowland near Antarctic bay, and these were striated on two opposite sides. Possibly they were thrown on shore by ice-pressure. In North-East Greenland Prof. Nathorst was unable to make such a detailed geological survey as in König Karl Land, owing to the time and attention necessarily given to the mapping of the geographical features. Nevertheless, he made considerable additions and corrections to the geological map. On the Austrian map the Hekla Hook formation is represented as occurring on the north coast of Franz Josef fiord; but Prof. Nathorst soon perceived that two different formations were present, which he took to be Silurian and Devonian, and this conclusion was subsequently found to be correct. Towards the western extremity archæan rocks appear, consisting of gneiss and mica-schists, with a dip generally to the east and a northerly strike. To the east of it are sedimentary formations, partly at least of Silurian age. The Silurian strata are folded and compressed, sometimes inverted. If the folding had any connection with the formation of a mountain range, it must have taken place before the deposition of the Devonian beds, for the latter are comparatively little disturbed. A later formation, probably Jurassic, surrounds Antarctic harbour on the western shore of Davy sound, and perhaps the Keuper and Jurassic strata extend further, from Hurry inlet. Late eruptive rocks, as already shown by Toula, form a belt along the coast, and several specimens were collected. The whole region bears signs of glaciation. Terraces occur in all places adapted for their formation. Of special interest among Quaternary fossils is the *Mytilus edulis*, which was found at the mouth of Sofia sound and at the head of Franz Josef fjord at a height of not more than 30 feet above the water. Mussels are not found, living, north of 66°, and could not now exist in the fjord, where icebergs are constantly calved and drift about.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Bedding, Foliation, and Movement of Glacier Ice.—Prof. Hans Crammer, of Salzburg, who has made extensive observations on the structure and movements of glacier ice, has brought forward a theory explaining the relation of these phenomena, a full account of which will be published shortly. A summary of the chief points to be dealt with in the larger memoir appears in the *Centralblatt fur Mineralogie* (No. 2, pp. 103-107, 1902). The structure usually termed stratification or "banding" (*Bänderung*) in glacier ice (see E. Richter, "Die Gletscherkonferenz in 1899," *Pet. Mitt.*, pp. 77-81, 1900; also *Geographical Journal*, xiv. p. 316, 1899) Crammer calls more accurately foliation (*Blätterung*), the stratification being merely the appearance of the foliated structure at an external surface. Attention was first drawn to this point by the American geologist, A. F. Reid, at the International Congress of Geologists, in Paris, in 1900, and again, independently, by Hans Hess (*Neues Jahrbuch für Mineralogie*, Bd. i. pp. 23-34, 1902). Crammer's conclusions have been reached from an altogether different standpoint; they were first announced by him at a meeting of geographers in Vienna in 1901. The different rates of motion observed on a cross-section of a glacier make it impossible to regard its movement as a mere sliding of the mass of ice as a whole; the phenomenon is rather a sliding of one particle over another, or differential motion, which takes place chiefly where the cohesion of the ice "molecules"—the *Körner*, or ice-crystals is weakest, *i.e.* at the interfaces of the beds originally formed in the *Firn*. The dust deposited on the surface after each fall of snow interposes an extremely thin layer of foreign material which separates the strata of the field ice from one another. This is the primary cause of stratification, and the stratification prevents the growth of the ice-crystals, which is due to subsequent pressure, from extending out of one layer into another. The crystals in different layers adhere strongly to one another only when the temperature is well below the freezing-point, and the observations of Forel, Drygalsky, and Hess have shown that at a distance from the surface the temperature is constantly that of melting ice. Hence the layers tend to glide easily over one another during the whole progress of the glacier from beginning to end.

Capture of Sub-aërial by Subterranean Streams.—In the *Comptes Rendus* for December 2 last, M. E. Fournier gives several instances which show that, in limestone regions, the phenomenon of the capture of superficial by underground streams is by no means so rare as might be imagined. The most important instance cited is that of the source of the Loue, which M. Fournier's researches have shown to owe its water-supply not only to leakages from the Doubs (the connection in this case has been positively proved by the recent fire at the Pernod works, during which a quantity of absinthe was poured into the Doubs), but to similar losses from the Drugeon, which supply the subterranean stream at the pit of Jardelle, and from the closed basin of Arc-sous-Cicon. An example of double capture is thus progressing under our very eyes, and similar phenomena play, M. Fournier thinks, an important part in the evolution of hydrographic networks, and also in the progressive desiccation of high limestone plateaux. The formation of cañons may likewise often have its first origin in this way, their excavation beginning at the lower levels.

The Influence of Rainfall on Commerce and Politics.—Mr. H. Helm Clayton, of Blue Hill Observatory, has an instructive article on this subject in the *Popular Science Monthly* for December, 1901. He cites the works of Wills, Dawson, Maxwell-Hall, and others in comparing rainfall, stock-rearing, or sugar-production, but erroneously ascribes Sir Charles Todd's researches into the relationship of rainfall and wheat to Wills. He shows that in the United States, as we

might anticipate in a country hitherto so largely dependent on its production of food-stuffs and organic raw materials, that "every severe panic has been closely associated with a period of deficient rainfall." The panic of 1856 followed the dry years of 1854–6; that of 1873 came after the drought of 1870–2; that of 1887–95 was accompanied in the severest years of drought, 1893–4, by a panic, and financial depression persisted from 1893 to 1897. He then shows how the elector, ascribing such crises to political action, has turned against the party in power, and so brought about political crises, though we doubt if the change of parties in Britain in 1895 can be primarily ascribed to such a cause as Mr. Clayton suggests. He would explain the retention of power by ministries in Britain, France, Canada, and the United States in recent years as in part at least a function of increased rainfall and increased prosperity. We cordially echo his wish that "some wise benefactor would found an institution purely for research, where all such questions of man's relation to the universe would be carefully investigated by trained investigators, using the well-tried and fruitful methods of science." How far politicians would welcome such scientific study is another question.

GENERAL.

Awards of the Russian Geographical Society.—At its meeting of February 5 the Russian Geographical Society awarded its Constantine medal to K. I. Bogdanovich, the explorer of Central Asia, for his many years' work; the Semenoff medal was awarded to Eduard Suess, for his classical work, 'Das Antlitz der Erde;' and the Prjevalsky medal to the zoologist, Prof. N. A. Zarudnyi, for his last journey in Eastern Persia and previous work in ornithology in the Transcaspian region. The great gold medal of the Statistical section was given to N. Y. Sliunin, for his elaborate work, 'The Okhotsk-Kamchatka Region,' and his general researches into the economic conditions of the Okhotsk and Kamchatka littoral; and three small gold medals were awarded to engineer N. P. Petrovsky, for his article, 'The Tazes or U-di-khe;' the student D. K. Zelenin, for his work 'On the Popular Songs of the Yarensk District;' and M. N. Kosich, for an article on 'The White Russians of Chernigov'—all these works having been published in *Zhivaya Starina* ('Living Antiquities'), the review of the Ethnographical Section of the Geographical Society. The two large silver medals were awarded—the Prjevalsky medal to Prof. Gordyaghin, for his botanical work in East Russia, and the Semenoff medal to A. K. Bulatovich, for his journey to Lake Rudolf. Small silver medals were given to seventeen persons for various minor work made in connection with the Society, chiefly in meteorology.

OBITUARY.

M. Charles Maunoir.

We regret to announce the death of M. Charles Maunoir, honorary secretary of the Paris Geographical Society. M. Maunoir, who was an Honorary Corresponding Member of the Royal Geographical Society, resigned some five years ago the general secretaryship of the Paris Society, a post which he had filled with great distinction for thirty years. He died, after a long and painful illness, on December 22, in the seventy-second year of his age. Himself a scientific geographer in the strict modern acceptation of the term, he could recall the time when geography was, as it were, somewhat of a Cinderella among the sciences. Indeed, it was no small

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... was formed in France of the ... the first in that country to take ... geographical science, to realize the ... point of view, of its systematic study, ... it a proper standing amongst the ... say how successful have been his

... Geneva, where he received his early ... army, but a year later an accident ... he was transferred from his regiment to ... Office. Fourteen years later, in 1867, he ... Paris Geographical Society, and began the ... known in French geographical circles. ... Society was a learned society in the narrowest ... deliberant." Its membership was small; ... at once set himself to remedy this state of ... and genial personality, as well as to his wide ... of the lines on which geographical science ... Society now occupies in France a position very ... this country. His *Rapports annuels sur les* ... provide a history of geographical work from 1867 ... received wide-spread recognition. M. Maunoir took ... geography, especially in its bearings upon political ... which have formed so important a feature in ... Empire always received his warm support. M. ... Legion of Honour, and in 1892 was awarded by the ... special gold medal for his services to geographical ... work he has accomplished will recognize the loss ... the geographical world as a whole—has sustained ... his personal acquaintance will remember him as ... kindly of men.

Professor Mushketoff.

... Society and geographical science altogether have ... the death of Prof. Ivan Vasilievitch Mushketoff, who ... years president of the Physical Geography section of ... Society. He was born in 1850, in south-eastern Russia, ... Cossacks of the Don, and received his first education in the ... At the age of barely seventeen he was at the uni- ... which he joined in its philological faculty; but, happily ... abandoned philology and entered the Mining Institute. There, ... years, he made and published his first scientific researches ... of Volhynia, and in 1873, as soon as he had termi- ... the Mining School, he was sent out for exploration work to ... discovered and described a formation of arseniated minerals, ... to the distribution of gold. In this same year he published ... the Ural Society of Naturalists, a paper on the mineralogy ... and received his nomination as a mining *attaché* to the ... of Turkestan. The six years which young Mushketoff spent ... journeys the importance and extent of which increased every ... of the geologist and geographer. He first visited the

western Tian Shan and Kulja, as also the southern Urals; but from 1877 he extended his journeys to the Alai mountains and the Pamirs, to Lake Chatyr kul; next to Bukhara, Hissar, the Amu, and the Kyzyl kum desert. In 1880 he made a great journey to the Zerafshan glaciers, where he found unmistakable traces of a wide glaciation; and six years later he published a remarkable work in Russian, 'Turkestan,' in which he laid the foundations of the geology of this important portion of Asia. Unfortunately, only the first volume of this valuable work was published, Mushketoff being prevented from finishing it, partly by his new duties as professor at the Mining Institute, and partly by the new interest he took in the Caucasus, after he had made a journey thither for the exploration of its glaciers, mineral waters, and manganese ores. Moreover, since 1882 he became chief geologist of the newly formed Geological Committee, and thus had to devote part of his time to the geological survey of Russia. Besides, a journey to Turkestan, for the investigation of the great earthquake of Vyernyi, involved him in the study of earthquakes, while in 1885 he became president of the Physical Geography section of the Geographical Society. In this capacity he had to take a lively part in all the scientific—meteorological, seismical, geodetical, etc.—work of the society, and, with P. P. Semenoff, in equipment of all the expeditions organized by the Society.

Beside the work on 'Turkestan,' a geological map of the region, which he published in company with Prof. Romanovsky, and numerous smaller papers, Mushketoff published during these years the first volume of a very well-written course of physical geology, and a short course of 'Petrography.' He started also the collecting of materials concerning the earthquakes in Russia, and edited the most valuable work, by Orloff, 'Catalogue of Earthquakes in Russia,' which its author had not been able to publish during his lifetime. Moreover, Mushketoff managed to find time for editing the excellent 'Year-book' of the Geographical Society, which contains a full review of all geographical, geodetical, zoographical, phytographical, ethnographical, and statistical work done every year both in Russia and elsewhere, and having a bearing on the exploration of the Russian Empire. Since 1895, he was also the representative of Russia in the International Committee for the registration of the oscillations of the glaciers, and in this capacity he edited the corresponding observations which were made in the Caucasus and Turkestan. His last work was in the Trans-caspian Steppes, and in discovering the best direction for the tunnel through the main Caucasus range.

During the Congress of Russian naturalists, which took place at St. Petersburg last Christmas, Mushketoff was one of the most energetic organizers, and it was at one of the official festivities that he caught a cold which brought him to the grave. The Russian papers speak with great warmth of the late professor, and insist especially on his personal amiable qualities and the warm interest he always took in the defence of the students, especially during recent disturbances.

A very good short biography of Mushketoff, with a list of his chief works, is given in the thirty-ninth volume of the new Russian 'Encyclopædic Dictionary.'

General M. V. Pyevtsoff.

The Russian Geographical Society has sustained a great loss through the death of General Mikhail Vasilievich Pyevtsoff, the well-known explorer of Central Asia. He was born in 1843, and received his education in a military school, and afterwards at the Nicholas Military Academy of the General Staff. The first fifteen years of his military career, after he had left the Academy, he spent at Omsk, which was then a centre for the exploration of Central Asia.

In 1876, he made a journey in Jungaria, from Lake Zaisan to the Chinese town Gu-chen, during which he did excellent geodetical work, astronomical, magnetical, and hypsometrical. He gave also vivid descriptions of both the desert situated between the Saur mountains and the Southern Altai and the Torguts, the Dungans, and the Tian-shan Chinese. For this journey he was awarded by the Russian Geographical Society a small gold medal.

Two years later, 1878–1879, he made a still more remarkable journey *viâ* Kobdo to Kuku-khoto (Gui-hua-chen) and back *viâ* Urga. The results of this journey, during which 2700 miles of survey were made and twenty-nine points were determined astronomically, were very important, and in 1885 the Russian Geographical Society awarded to Pyevtsoff its Lütke medal. The results of the first expedition were published by Pyevtsoff in the *Memoirs* of the West Siberian branch of the Russian Geographical Society (vol. i., Omsk, 1879), and those of the second were embodied in a work, "Sketch of a Journey to Mongolia and the Northern Provinces of China," in the same *Memoirs*, vol. v., 1883, which is perhaps the best work we have on North-Western Mongolia.

Four years later, in 1882, Pyevtsoff took part in the great survey which was made to settle the boundary between Western China and Russia, and covered 30,000 square miles with his surveys. He also worked out during this survey the method of determination of latitude by means of the corresponding heights of two stars, which was an extension of N. Tsinger's method of determining time by corresponding heights of different stars, and, with the aid of Pyevtsoff's tables, proved afterwards of great value in subsequent expeditions.

When Prjevalsky suddenly died in 1888, at the moment of starting for a new Tibet expedition, Colonel Pyevtsoff was nominated the head of this expedition, and travelled, in company with Roborovsky, Kozloff, and Bogdanovich, during the years 1889–90 in East Turkestan, Northern Tibet, and Jungaria. The results of this expedition, during which more than 6000 miles of survey were made and the aspect of the Kuen-lun was entirely changed on our maps, are well known. They were embodied in three quarto volumes, 'The Work of the Tibet Expedition' (St. Petersburg, 1895–98), which, besides their purely geographical value, are very interesting reading, on account of the descriptions of life in East Turkestan given by Pyevtsoff. For this expedition the Russian Geographical Society awarded him its great Constantine medal in 1892.

Pyevtsoff also published a text-book of mathematical and physical geography. Of his smaller geodetical papers, the following are especially worthy of notice: "On the Determination of Latitudes by the Corresponding Heights of Two Stars," in *Memoirs* of the Russian Geographical Society, General Geography, vol. xvii., 1888; and "Barometric Levelling," in the same periodical, vol. xxix., 1896. An analysis of his work was given in the Annual Report of the Russian Geographical Society for 1891.

Captain Bonnevie.

Captain Törres Bonnevie, our Norwegian agent for the relief ship *Morning*, worked so zealously and so conscientiously for the Society, that his death ought not to pass without notice. Born at Grimstad in 1836, young Törres Bonnevie went to sea at the age of thirteen, and became master of a ship at the age of thirty-one. He was employed for some years conveying emigrants from Norway and Belgium to New York, and during the last years of his sea-service he commanded the steamer *Alpha*, of Christiansand, plying between Antwerp, Norway, and the German ports in the

Baltic. For twenty-eight years, from 1874 to the time of his death, Captain Bonnevie was surveyor to the Norwegian "Veritas" for ports on the southern coast, residing at Laurvik. He thus acquired a very intimate knowledge of the build and requirements of sealing and whaling vessels; and was latterly much engaged in selecting and fitting out ships for polar explorers: the Danish ship, *Godthaab*, the *Frithjof* for Mr. Wellman, the *Capella* relief ship, the *Jason* for the Duke of the Abruzzi, the *Harald Haarfager* for Baron Toll, the *Morning* for us, and the *Hecla* for Mr. Bruce. All valued his services very highly.

Captain Bonnevie was a thoroughly straightforward, honest, conscientious, and zealous agent, and a most kind-hearted man. It is to be feared that he latterly overtaxed his strength, for complete rest was necessary for him. He died on February 26, 1902.

Dr. Emil Holub.

The well-known African explorer, Dr. Emil Holub, died on February 21, 1902 at the age of fifty-four, after a long and severe illness, due to malarial fever acquired in the Zambezi valley. Born on October 7, 1847, at Holitz (Pardubitz) in eastern Bohemia, Dr. Holub studied medicine and natural science at Prague. His interest in exploration was largely the result of a study of the journeys of David Livingstone, and in 1872 he went to South Africa as a doctor on the diamond fields. The first of his smaller journeys was undertaken in February, 1873, when he traversed the southern Bantu region; in November of the same year he visited the Transvaal and the districts immediately to the north. The first journey on a larger scale started in March, 1875, and extended to the Zambezi and the Victoria falls. This expedition was cut short by an accident, but not before extensive scientific collections had been made, which Dr. Holub brought to Europe in 1879, and distributed in 113 Austrian and foreign museums and schools. Four years later he again set out for Africa, accompanied by his wife, with the intention of traversing the entire continent northwards from Cape Town. This plan had to be abandoned on account of the troubles in the Sudan, and instead he undertook a journey to Lake Bangweolo, intending to explore the unknown Matoko and Mashukulumbi countries, and the northern Zambezi region. But at Galulonga, on the Kafue, a tributary of the Zambezi, within sight of the mountain named by him Franz Josef Berg, his camp was attacked and plundered by the Mashukulumbe (August, 1886), and he had to return, having lost nearly all his collections and even his journals. Some time was spent at the mouth of the Chobe, and the collections made at that time form Dr. Holub's most important contributions to science. He returned to Europe in 1887, bringing with him no less than 13,000 objects, which he again distributed in museums and schools, after exhibiting them in Vienna (1891) and Prague (1892). His scientific reports amply testify to the wide range of his observations, and his popular lectures were well known both in Europe and America. His chief published works are: 'Kulturskizze des Manutse-Mabundareiches' (Vienna, 1879); 'The Victoria Falls' (Grahamstown, 1879); 'Sieben Jahre in Südaffrika' (2 vols., Vienna, 1880–81); 'Die Kolonisation Afrikas' (Vienna, 1882); 'Beiträge zur Ornithologie Südafrikas' (Vienna, 1882, in collaboration with von Pelzeln); and 'Von Kapstadt in's Land der Mashukulumbe' (2 vols., Vienna, 1888–90).

CORRESPONDENCE.

The Kinsha River of West China.*

In the *Geographical Journal*, vol. viii. p. 515, reference is made to M. Bonin's discovery, when travelling in the south-west of China, that below the sharp angle made by the Kinsha near the town of Li-kiang, the river (of Golden Sand) makes a wide sweep to the north, joining the Yalung in about 28° N. lat. instead of 26° 35′, as has been hitherto supposed.

In a note on this discovery, it was remarked that M. Bonin did not trace the river continuously during its northward sweep, but that it is to be supposed that he did not fall into the error (otherwise attributable to M. Hosie) of mistaking a tributary for the main stream. The writer adds, "Is it just possible that a bifurcation takes place, such as was hinted at in a neighbouring region by Lieut. Garnier?"†

In a paper on the Yang-tse, published in the *R.G.S. Journal*, vol. xii. p. 229, I adduced some reasons to show that it was unlikely that the Kinsha joined the Yalung at the point mentioned, and I find that in the *Bulletin de la Société de Géographie de Paris*, 1898, p. 395, M. Bonin writes that a mistake had been made owing to "l'interprétation hâtive des renseignements trop succincts que j'avais envoyés."

M. Bonin writes: "À un jour de Yun-ning-tou-fou l'itinéraire passe au dessus du lit du Yang-tse-kiang que toutes les cartes représentaient jusqu'ici comme coulant à près d'un degré, 100 kilomètres plus au sud. Le Fleuve Bleu, en effet, à partir du bac d'Ashi où je l'avais traversé, décrit une immense courbe vers le nord qui n'a été vue par aucun voyageur. Il tourne ainsi autour d'un grand massif montagneux dont les summits (au sud le pic de Li-kiang, au nord le mont Koa-tyu) varient entre 5000 et 6000 métres d'altitude.

"Les renseignements pris à Tali m'avaient mis sur la voie de cette découverte; elle me fut confirmée d'autre part par les itinéraires des caravaniers qui font la route entre Tat-sienlon et Tali et affirment passer le Fleuve Bleu près de Fong-ko, à un jour et demi au sud de Yun-ning-tou-fou. . . . Quant au cours du fleuve entre le bac d'Ashi et la région de Yun-ning-tou-fou, puis de là jusqu'aux points où il fut coupé par les itinéraires de Francis Garnier et de Hosie, il n'a été dessiné sur la carte ci-jointe que pour mémoire, aucun Européen ne l'ayant reconnu entre ces trois sections. Tout ce que je puis affirmer, c'est que le grand cours d'eau qui coule à un jour de Yun-ning-tou-fou est bien le même que celui que j'avais franchi au bac d'Ashi, c'est à dire le Yang-tse-kiang, Kin-sha-kiang ou Ashi-kiang comme l'appelaient mes caravaniers chinois près de Yun-ning même.

* * * * * * * * * *

"Quant au cours d'eau qui descend vers le sud du pic de Li-kiang et que les cartes représentaient comme le cours même du Yang-tse redescendant immédiatement après avoir contourné le pic, c'est en réalité un affluent de droite du Fleuve Bleu qui porte le nom chinois de Pe-shui-kiang."

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* Dr. Jack's map in the March number of the *Journal* may be consulted. It should, however, be pointed out that the route crossing the Kinsha in 26° 15′ N. should have been marked as Hosie's, not Garnier's, the latter traveller having kept to the south of the river until about 101⅜° E.

† In a subsequent note, which appeared in the *Journal* for May, 1899 (p. 532), we referred to the rectification by M. Bonin, quoted by Mr. Carles in the next paragraph, and showed that it removed the difficulty to which attention had been drawn in the first note.

In the map which accompanies his paper, M. Bonin gives an imaginary sketch of the course which the Yang-tse takes after this immense bend northward, and connects it with the course generally shown on maps a little west of Chin-chiang-kai, where M. Hosie crossed it in 1883.

But if M. Bonin's theory is correct, the bend taken by the river must be even more extraordinary, for, as I mentioned in my paper, Dr. A. Anderson, of the C.I.M., had crossed the Yang-tse by the iron bridge near Li-kiang, where the river is called the Chin-sha, and had struck it again above its confluence with the Yalung, and spoke of its describing an immense curve from the south before joining the Yalung, to avoid a large mountain.

This information has now been supplemented by the journey made by Dr. Jack, of which he gave an account at the R.G.S. meeting of January 13. Dr. Jack, who crossed a section of country between Yung-pei and Li-kiang, which has not, I think, been previously described, states that he crossed the Yang-tse (left to right) by an iron suspension bridge, 5 chains in length, 27 miles west of Yung-pei, at an elevation of 4400 feet, below the mouth of the river which drains Po-lo and Yung-pei, and that the city of Li-kiang was only 16 miles from the bridge, which I presume is the same bridge as that mentioned by Dr. Anderson. If the Yang-tse returns from the point where M. Bonin struck it in its north bend to within 16 miles east of Li-kiang, the curve described by it lacks little to complete a circle.

The existence of such a bend explains the disappearance of the river Wu-liang, which is shown in Dr. Bretschneider's map as well as others as descending from the north of Litang, almost due south, until it joins the Yang-tse, south-east of Li-kiang. This river may be the same as either the "Tua-tze-ho" or the Senji, crossed by M. Bonin between Chung-tien and Yung-ning, which enter the Kin-sha in the upper part of its bend north. Much mystery still attaches to the course of these rivers, as well as to that of the Yalung, and it is to be hoped that the journey made from Wei-si towards Li-tang by Major Manifold and Captains Ryder and Davies in September, 1900, has thrown further light upon them.

I cannot but think that M. Bonin must be mistaken in considering the Pai-shui-kiang to be an affluent of the Yang-tse, for the information furnished both by Lieut. Garnier and by Mr. Hosie tends to prove that the Yang-tse at that part of its course is called by that name. On the other hand, the confusion of names mentioned by Lieut. Garnier may mean that there is yet something further to be learnt about that part of the Yang-tse. It is, unfortunately, only of places here and there that accurate information with regard to the course of the Yang-tse above Ping-shan has been obtained. For the rest, the greater portion of its route, the position shown in maps rests mainly on conjecture.

W. R. CARLES.

The Belgian Antarctic Expedition.

Le mars 17, 1902.

DANS le dernier numero du *Geographical Journal*, p. 387, a paru une rectification de M. Pelseneer à l'égard de certaines erreurs que M. Arçtowski a commises dans sa lecture sur l'Expédition Belge Antarctique (*Geographical Journal*, October, 1901). M. Arçtowski a cité mon nom dans son réponse à M. Pelseneer. J'ai été, en effet, quelque peu mêlé aux préliminaires de l'expédition, et je puis affirmer, en ce qui me concerne, que je n'aurais pas donné mon approbation au projet de M. de Gerlache s'il s'était agi d'un simple voyage d'aventure. La commission de trois membres dont je faisais partie et qui avait été choisie dans le sein du Comité Central de la Société de Géographie n'a conclu au patronage de la Société que

parceque dès le début M. de Gerlache insista sur les résultats scientifiques qu'on pouvait attendre d'une expédition antarctique à laquelle il voulait adjoindre des savants qui, à ce moment, n'étaient pas encore désignés. Lorsque le mémoire de M. de Gerlache a été soumis à la Commission, il ne contenait pas les corrections auxquelles fait allusion M. Arctowski ("scrutinized—his words"). Si ces corrections ont apparu plus tard, c'est là un fait qui pourrait être vérifié au besoin dans les archives de la Société.

JULES LECLERCQ,
Président de la Société Royale Belge de Géographie,
Membre Correspondant de la Royal Geographical Society.

The Sobat System.

Major Austin has now supplied, in his letter printed in the March number of the *Journal*, an explanation which completely removes any doubt as to the correctness of his identification of Wellby's "river 30 yards broad" with the Gelo. The difficulty, to which attention was called in the note in the *Journal* for September last, arose solely from the discrepancy between the latitude of the mouth of Wellby's river as shown on his map and of the Gelo as shown by Major Austin—a discrepancy which, if the former's supposition as to the course of the Ruzi where not actually traced by him had been correct, would have amounted to some 20′. By showing that the Ruzi really makes a sweep to the west below the point where it was left by Wellby, and that the "river 30 yards broad" therefore joins it some 50 miles lower down than was supposed by that traveller, Major Austin has not only removed the difficulty alluded to, but has made it much easier than it had seemed to fit in Wellby's work with that of other travellers.

E. H.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1901–1902.

Seventh Ordinary Meeting, February 24, 1902.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS:—*Wm. Edward De Winton; James George Hooper; Lieut.-Colonel A. F. Montanaro, R.A.; William Muir; Charles Pharazyn; Jacob Crawford Pharo; William Herbert Purvis; Walter Sydney Howard Smith; Chauncey Hugh Stigand (Lieut. 1st Queen's Own Royal West Kent).*

The PRESIDENT: I must refer, first of all, to the loss of the oldest Fellow of this Society, Lord Fitzwilliam—that is to say, our senior Fellow. He had been a Fellow for sixty-five years, and after his death, which happened a very short time ago at a good old age, we no longer have any Fellows who date from the thirties. We have also sustained a great loss, and the country has sustained a great loss, in the death of the Marquis of Dufferin and Ava. Lord Dufferin was not a scientific geographer, but he was a most accomplished traveller, and as President of this Society he was equal to his predecessors and to his successors in his earnest and enthusiastic desire to further the cause of geographical research, and in his profound conviction of the value and importance of the functions that are discharged by the Society. Lord Dufferin was always genial, he was a most charming colleague, and we were deprived of him very prematurely when he had to go as Ambassador to St. Petersburg. After that he was so constantly in great public

employments that he had very little time to attend to geography; still, he was always anxious to help us in our work, and when I saw him at Rome he was full of interest in the explorations that were then going on. The very last time I spoke to him he conversed with me, with great interest, on the very subject which is going to occupy us this evening—the Antarctic Expedition. You may rely on the accuracy of what I am going to read to you, for it is copied from the letters of Captain Scott and of other officers of the Expedition.

The Papers read were:—

"The Voyage of the Antarctic Ship *Discovery*." By the President; George Murray, Esq., F.R.S.; and Hugh Robert Mill, Esq., D.SC., LL.D.

Eighth Ordinary Meeting, March 10, 1902.—Sir CLEMENTS MARKHAM, K.C.B., F.R.S., President, in the Chair.

ELECTIONS.—*Frederick Alcock; Chas. Foreman Allison; Captain John Gerald Berne, R.A.M.C.; Captain Henry Barry Coddington, 37th Hampshire Regt.; William David Forbes; Edwin Ralphs; Edward Hugh Bowring Skimming; William J. Harding King; Walter Thomas Owen; Captain John Arthur Coghill Somerville, Northumberland Fusiliers; Sir Simeon Stuart, Bart.; Joseph Walton, M.P.; Captain G. F. A. Whitlock, R.E.*

The Paper read was:—

"The Geographical Conditions determining History and Religion in Asia Minor." By Prof. W. M. Ramsay.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

THE following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.	Mag. = Magazine.
Abh. = Abhandlungen.	Mem. = Memoirs, Mémoires.
Ann. = Annals, Annales, Annalen.	Met. = Meteorological.
B. = Bulletin, Bollettino, Boletim.	P. = Proceedings.
Com. = Commerce.	R. = Royal.
C. Rd. = Comptes Rendus.	Rev. = Review, Revue.
Erdk. = Erdkunde.	S. = Society, Société, Selskab.
G. = Geography, Geographie, Geografia.	Sitzb. = Sitzungsbericht.
Ges. = Gesellschaft.	T. = Transactions.
I. = Institute, Institution.	V. = Verein.
Is. = Isvestiya.	Verh. = Verhandlungen.
J. = Journal.	W. = Wissenschaft, and compounds.
k. u. k. = kaiserlich und königlich.	Z. = Zeitschrift.
M. = Mitteilungen.	Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Germany—Elbe. *Z.K. Sächs. Statist. Bureaus* 47 (1901): 1–29. Ganzenmüller
Statistik des sächsischen Elbverkehrs in den Jahren 1880 bis 1899. Von Dr. Konrad Ganzenmüller.

Germany—Elbe. *M.V. Erdk. Halle-a.-S.* (1901): 46-47. **Maenss.**
Bewegung des Elbwasserstandes bei Magdeburg 1891-1900. Von Prof. J. Maenss. *With Diagrams.*

Germany—Meteorology. *Ann. Hydrographie* **29** (1901): 573-583. **Grossmann.**
Die Aenderung der Temperatur von Tag zu Tag an der deutschen Küste in den Jahren 1890 bis 1899. Dr. Grossmann.

Germany—Oder. **Winkelmann.**
Bericht Ges. Völker- u. Erdk. Stettin (1899-1900): 35-36.
Die Bildung des linken Oderufers von Stettin bis Pölitz. Von Prof. Dr. Winkelmann.

Germany—Riesengebirge. *G.Z.* **7** (1901): 583-590. **Friederichsen.**
Die Riesengebirgs-Exkursion des XIII. Deutschen Geographentages (31. Mai bis 2. Juni 1901). Von Dr. Max Friederichsen. *With Illustrations.*

Germany—Saxony. ———
Kalender und Statistisches Jahrbuch für das Königreich Sachsen . . . auf das Jahr 1902. Dresden, 1901. Size 9½ × 6½, pp. 320.

Germany—Stettin. *Bericht Ges. Völker- u. Erdk. Stettin* (1899-1900): 5-12. **Keilhack.**
Zur Geologie und Morphologie der Umgebung Stettins. Von Dr. Keilhack. *With Maps.*

Germany—Yew. *M.V. Erdk. Halle a. S.* (1901): 66-69. **Gerbing.**
Die Eiben des Ringgaues und des Eichsfeldes. Von Luise Gerbing.

Greece—Paxos and Antipaxos. *B.S.G. Italiana* **2** (1901): 769-792, 859-882. **Martelli.**
Paxos e Antipaxos nel mare Jonio. Studio geo-fisico del dottor Alessandro Martelli. *With Map and Illustrations.*

Hungary. *Ann. G.* **10** (1901): 438-444. **Lacger.**
La plaine hongroise: Alföld et Puszta. Par M. l'abbé L. de Lacger.

Hungary—Salt-lakes. **Kalecsinsky.**
Ueber die Ungarischen warmen und heissen Kochsalzseen als natürliche Wärme-accumulatoren, sowie über die Herstellung von warmen Salzseen und Wärme-accumulatoren. Von Alexander v. Kalecsinsky. Budapest, 1901. Size 10 × 7, pp. 26. *Presented by the Author.*

Iceland—Moraines. **Pjetursson.**
Oversigt K. Danske Vidensk. S. Forhand. (1901): 147-170.
Moræner i den islandske Palagonitformation. Af Helgi Pjetursson. *With Map.*

Italy. *Le Globe, Mém. S.G. Genève* **40** (1901): 85-109. **Chaix.**
Notice sur les Vallées Vaudoises du Piémont. Par Paul Chaix. *With Map.*

Italy—Lakes. *Riv. G. Italiana* **8** (1901): 641-648. **Marinelli.**
Lo studio delle sesse nei laghi italiani. Per Olinto Marinelli.
Observations on the "seiches" in various Italian lakes have lately been made.

Italy—Lemene. *Riv. G. Italiana* **8** (1901): 637-640. **Bertolini.**
Di una piena del fiume Lemene in relazione alla funzione moderatrice dell' Estuario. Nota del prof. G. Lodovico Bertolini.

Italy—Po Delta. **Marinelli.**
L'Accroissement du Delta du Po au XIX[ème] Siècle. Par S. Marinelli. (Université Nouvelle, Institut Géographique de Bruxelles. Publication No. 6.) Bruxelles: Ferdinand Larcier, 1901. Size 10 × 6½, pp. 36. *Map. Presented by the Institut Géographique de Bruxelles.*

Lake of Constance. *M.G. Ges. Wien* **44** (1901): 262-269. **Fuchs.**
Die Verbreitung der Thierwelt im Bodensee. Von Theodor Fuchs.

Monte Rosa. *Atti R.A. Lincei, Rendiconti* **11** (1902): 24-29. **Dainelli.**
Stato attuale dei ghiacciai del Monte Rosa. Nota di G. Dainelli.

Portugal and Flanders. *B.S.G. Lisboa* **18** (1900): 15-27. **Cantineau.**
Origine des relations commerciales entre la Flandre et le Portugal. Por E. Cantineau.

Russia—Baltic Provinces. *Deutsche Rundschau G.* **24** (1901): 70–77. **Stenin.**
Die Talabskischen Inseln auf dem Pleskauer See. Von P. von Stenin. *With Illustration.*

The Pleskauer See or lake of Pskov is the southern portion of Lake Peipus.

Slav Race. *Bericht Ges. Völker- u. Erdk. Stettin* (1899–1900): 22–25. **Buschan.**
Verbreitung, Eintheilung und Ursprung der slavischen Völkerstämme. Von Dr. Buschan.

Sweden—Plant-life. **Cleve.**
Bihang K. Svensk. Vetens.-A. Handlingar **26** (1901): No. 15, pp. 105.
Zum Pflanzenleben in nordschwedischen Hochgebirgen. Einige ökologische und phänologische Beiträge. Von Astrid Cleve. *With Plates.*

Switzerland. ——
Annuaire Statistique de la Suisse. Publié par le Bureau de Statistique du Département Fédéral de l'Intérieur. Dixième Année, 1901. Bern, 1901. Size 10 × 6½, pp. 368.

Switzerland. **Felber.**
Die Allmenden des alten Landes Schwyz. Von Theod. Felber. (Festschrift der Geographisch-Ethnographischen Gesellschaft in Zürich, pp. 61–84.) Zurich: F. Lohbauer, 1901. Size 9 × 6½. *Map.*

On the historical and economic development of the land corporations of Schwyz.

Switzerland—Fauna. **Stoll.**
Über xerothermische Relikten in der Schweizer Fauna der Wirbellosen. Von Prof. Dr. Otto Stoll. (Festschrift der Geographisch-Ethnographischen Gesellschaft in Zurich, pp. 145–208.) Zurich: F. Lohbauer, 1901. Size 9 × 6½.

Switzerland—Glaciers. *B.S.G. Italiana* **2** (1901): 916–929. **Marson.**
Sui ghiacciai del Bernina, conclusioni e nota suppletiva sui dati idrografici del Màllero. Del Prof. Luigi Marson.

Switzerland—Loess. *Verh. Naturforsch. Ges. Basel* **13** (1901): 271–286. **Gutzwiller.**
Zur Altersfrage des Löss. Von A. Gutzwiller.

Turkey—Crete. *Ann. G.* **10** (1901): 445–446. ——
Mission de MM[rs] Ardaillon et Cayeux dans l'île de Crète. Par V. L.

This expedition, undertaken early in 1901, had in view geological and geographical research (see *ante*, p. 212).

Turkey—Mitylene. *B.S.G. Com. Bordeaux* **27** (1901): 353–359. **Girard.**
L'île de Mételin. Par B. Girard.

United Kingdom. **Mackinder.**
Britain and the British Seas. By H. J. Mackinder. London: W. Heinemann, 1902. Size 9½ × 6, pp. xvi. and 378. *Maps and Illustrations. Presented by the Publisher.*

This is the subject of a review (*ante*, p. 489).

United Kingdom—Hertfordshire. **Fordham.**
Hertfordshire Maps: a Descriptive Catalogue of the Maps of the County, 1579–1900. By Herbert George Fordham. First Part. (From the *Transactions* of the Hertfordshire Natural History Society, vol. xi. part i.) Size 10 × 7½, pp. 32. *Maps. Presented by the Author.*

United Kingdom—Ireland. *P.R. Irish A.* **6** (1901): 331–389. **Knowles.**
The Fourth Report on the Prehistoric Remains from the Sandhills of the Coast of Ireland. By W. J. Knowles. *With Illustrations.*

United Kingdom—Ireland. *P.R. Dublin S.* **9** (1901): 422–435. **Lyburn.**
Prospecting for Gold in co. Wicklow, and an Examination of Irish Rocks for Gold and Silver. By E. St. John Lyburn. *With Maps.*

United Kingdom—Ireland. *P.R. Irish A.* **6** (1901): 415–449. **Westropp.**
The Cahers of County Clare: their Names, Features, and Bibliography. By Thomas J. Westropp. *With Illustrations.*

A table shows the distribution of the forts—some 2400 in all—by parishes, the individual names with descriptions being given later.

ASIA.

China. **Navarra.**

China und die Chinesen. Auf Grund eines 20 jährigen Aufenthaltes im Lande der Mitte geschildert von B. Navarra. Zweiter Band. Bremen: Max Nössler, 1901. Size 9 × 6, pp. 497–1112. *Map and Illustrations. Price 9s.*

This is not a mere record of travel, but contains a large amount of solid information, based on a long residence in the country. The author was, until 1899, editor of the *Ostasiatischen Lloyd* of Shanghai.

China. *B.R.S.G. Madrid* **43** (1901): 166–272. **Olmet.**

El problema de la China. Ensayo por D. Fernando de Antón del Olmet.

China—Manchuria. *Deutsche G. Blätter* **24** (1901): 73–79. **Stavenhagen.**

Der Wert der Mandschurei für Russland. Von W. Stavenhagen.

French Indo-China. *B.S.G. Com. Paris* **22** (1901): 335–350. **Bel.**

En Indo-Chine, du Sous-Sol. Par M. J. Marc Bel.

Deals with the mining resources of French Indo-China.

French Indo-China. **Gervais-Courtellemont, Vandelet, and others.**

Empire Colonial de la France, L'Indo-Chine, Cochinchine, Cambodge, Laos, Annam, Tonkin. Préface par Marcel Dubois. Texte par Gervais-Courtellemont, Vandelet, etc. Paris: Firmin-Didot et Cie. and A. Challamel (not dated). Size 13 × 9½, pp. xvi. and 196. *Map and Illustrations.*

This is the second part of a well-illustrated popular description of the French Colonies, the first part of which dealt with Madagascar (*Journal*, vol. xvii. p. 676).

French Indo-China—Annam. *B.S.G. Com. Paris* **22** (1901): 383–384. **Barthélemy.**

Le régime économique de la Côte d'Annam. Par Cte. P. de Barthélemy.

French Indo-China—Laos. **Reinach.**

L. de Reinach. Le Laos. 2 vols. Paris: A. Charles (not dated). Size 11 × 9, pp. (vol. i.) 534; (vol. ii.) 174. *Maps and Illustrations. Price 32s.*

This work does for the northern interior of French Indo-China the service rendered for the more southern regions by M. Aymonier. Besides giving a general view of the physical geography and peoples of the country, the author (a former Government official in the Laos province) supplies a sketch of its political history, and full details as to its resources, trade, industries, means of communication, etc. The second volume consists entirely of appendices supplying notes on special points of interest.

India—Burma. **Nisbet.**

Burma under British Rule—and Before. By John Nisbet. 2 vols. Westminster: A. Constable & Co., 1901. Size 9 × 5½, pp. (vol. i.) x. and 460; (vol. ii.) viii. and 452. *Price 32s. Maps and Illustrations.*

This is naturally rather historical than geographical, but a section deals with the economic aspects of Burma.

India—Census. ———

Census of India, 1901. First Total. Showing variation in population since 1881, and percentage of variation. (Extract from the Proceedings of the Government of India in the Home Department (Census), under date Calcutta, the 15th March, 1901.) Size 13½ × 8½. *Presented by Mr. H. H. Risley, Census Commissioner.*

India—Madras. ———

Report on the Kodaikanal and Madras Observations for 1900–1901. Size 13½ × 8½, pp. 18.

India, &c. **Blanford.**

The Distribution of Vertebrate Animals in India, Ceylon, and Burma. By W. T. Blanford, F.R.S. (*Philosoph. Trans. Royal Soc.*, London, Series B., vol. 194, pp. 335–436.) Size 12 × 9. *Map. Presented by the Author.*

The whole of India, Burma, and Ceylon is divided for the purposes of this study into nineteen tracts, distinguished by physical characters, the main zoological features of each being afterwards considered. Apart from tracts forming parts of sub-regions extending beyond the limits of India, the whole is subdivided into two sub-regions, a western or Cis-Gangetic, and an eastern and northern (Trans-Gangetic), the latter extending also into Siam, S. China, etc.

Indian Ocean—Seychelles. *Ann. Idrografici* **2** (1901): 113–129. ———

Cenni sulle Isole Séychelles. Dati raccolti con la R. Nave Staffetta, comandante P. Botti, durante il suo soggiorno a Port-Victoria (1899).

Indo-China. **Leclercq.**
Voyage d'une Française dans l'Indo-Chine. Par Jules Leclercq. (Extrait de *La Revue Générale*, novembre, 1901.) Bruxelles: Oscar Schepens & Cie., 1901. Size 10 × 6½, pp. 12. *Presented by the Author.*

The traveller alluded to is Mme. Isabelle Massieu.

Japan—Formosa. **Wawn.**
Trade of North Formosa for the year 1900. Foreign Office, Annual No. 2728. 1901. Size 9½ × 6, pp. 16. *Price 1d.*

Malay Archipelago. **Pflüger.**
Smaragdinseln der Südsee. Reiseeindrücke und Plaudereien. Von Dr. Alexander Pflüger. Bonn: Emil Strauss (not dated). Size 10 × 6½, pp. x. and 244. *Maps and Illustrations. Price 10s.*

This profusely illustrated work gives the observations of a young German University lecturer during a voyage through the Malay Archipelago, during which visits were paid to various parts of Sumatra, Celebes, the Moluccas, Dutch and German New Guinea, and the Bismarck Archipelago.

Malay Archipelago—Amboina. **Verbeek.**
Verh. K.A. Wetens. Amsterdam (2) 7 (1900): No. 5, pp. 9.
Over de Geologie van Ambon (ii.). Door R. D. M. Verbeek.

Malay Archipelago—Borneo. **Beccari.**
Odoardo Beccari. Nelle Foreste di Borneo. Viaggi e ricerche di un Naturalista. Firenze: Salvadore Landi, 1902. Size 10 × 7, pp. xvi. and 668. *Maps and Illustrations. Presented by the Author.*

The greater part of this work describes the researches in Borneo, in 1865–68, of the well-known naturalist, Dr. Beccari, since known as a pioneer explorer in New Guinea. In spite of the time that has elapsed since the traveller first made acquaintance with the forests of Sarawak, the work is welcome by reason of the comparative scantiness of the literature on that part of the island. Dr. Beccari gives copious descriptions of the natural features as well as of the native races of the districts visited, and supplies a sketch of the recent development of Sarawak, partly from his own observations during a brief subsequent visit, partly from already published authorities.

Malay Archipelago—Celebes. **Sarasin.**
Entwurf einer Geographisch-Geologischen Beschreibung der Insel Celebes. Von Dr. Paul Sarasin und Dr. Fritz Sarasin. Weisbaden: C. W. Kreidel, 1901. Size 13 × 10, pp. xi., 344, and 28. *Maps and Plates. Price 50s.*

This important work will be specially noticed.

Malay Archipelago—Key Islands. **Langen.**
Die Key oder Kii-Inseln des O. I. Archipelago, aus dem Tagebuche eines Colonisten. Von Kapt. H. Gottfr. Langen. Wien: Carl Gerold's Sohn, 1902 [1901]. Size 9¼ × 6, pp. 69. *Map and Illustrations. Presented by the Author.*

Malay Archipelago—Sumatra. **Schlegel.**
Geographical Notes, XVI. The Old States in the Island of Sumatra. By G. Schlegel. (Reprinted from the T'oung-Pao, series ii. vol. ii.) Leyden: Oriental Printing Office, formerly E. J. Brill, 1901. Size 10 × 6½, pp. 98. *Presented by the Author.*

This will be noticed in the Monthly Record.

Persia. *J.S. Arts* 50 (1901): 65-78. **Penton.**
The New Trade Route to Persia by Nushki and Sistán. By Edward Penton, B.A. *With Map.*

Persian Gulf—Trade. **Kemball.**
Trade of Persian Gulf for the year 1900. Foreign Office, Annual No. 2631, 1901. Size 9½ × 6, pp. 50. *Price 3d.*

Russia. **Meister.**
Russland in Asien. Historisch-wirtschaftliche Skizze. Von M. Meister. (Festschrift der Geographisch-Ethnographischen Gesellschaft in Zürich, pp. 85–125.) Zurich: F. Lohbauer, 1901. Size 9 × 6½. *Map.*

The map shows the Siberian railway and other projected lines.

AFRICA.

Angola. *Miss. Catholiques* 33 (1901): 569-572, 581-584, 597-599, 610-612. **Lecomte.**
À travers la Haute-Cimbébasie. Rapport du R. P. E. Lecomte. *Map and Illustr.*

Angola. *Scottish G. Mag.* 17 (1901): 575-582. **Lewis.**
Itineraries in Portuguese Congo. By Rev. Thomas Lewis.

A paper read at the Glasgow meeting of the British Association.

Angola. **Negreiros.**
Colonies Portugaises: Angola. Brève Notice. Par A. d'Almada Negreiros. Paris: Alcan-Levy, 1901. Size 9½ × 6, pp. 48. *Map and Illustrations. Presented by the Author.*

British Central Africa. *P. Philosoph. S. Glasgow* 32 (1900-1901): 60-75. **Fraser.**
The Zulu of Nyasaland: their Manners and Customs. By the Rev. Donald Fraser.

British Central Africa. **Sharpe.**
Trade and General Condition of British Central Africa Protectorate for the Year 1900-1901. Foreign Office, Annual No. 2722, 1901. Size 9½ × 6, pp. 46. *Price 2½d.*

British Central Africa—Cacao Cultivation. **McClounie.**
Theobroma Cacao. Nos. 2 & 3, Scientific Series Local Circulars, Jan. and April, 1901.

British Central Africa—Livingstonia Mission. ———
The Livingstonia Mission of the United Free Church of Scotland (British Central Africa) Report for 1900. Size 8½ × 5½, pp. iv. and 80. *Map and Illustrations. Presented by United Free Church of Scotland.*

British East Africa. **Eliot.**
Africa. No. 9 (1901). Report by His Majesty's Commissioner on the East Africa Protectorate. London: Eyre and Spottiswoode, 1901. Size 13½ × 8½, pp. 26. *Price 3d.*

British East Africa. **Gregory.**
The Foundation of British East Africa. By J. W. Gregory. London: H. Marshall & Son, 1901. Size 8½ × 5½, pp. xii. and 268. *Map and Illustrations. Presented by the Publishers.*

This work is intended as a popular account of the course of events which have led to the acquisition for Great Britain of her extensive East African territory, and of the progress so far made with its development. It should prove of much use in enabling the general reader to gain an adequate idea of the history of British East Africa without being obliged to consult the numerous works in which the information is otherwise scattered. Dr. Gregory writes, as a rule, with full knowledge of his subject, and gives an instructive sketch of the dawn of East African geography, as well as of the modern explorations by which that geography has become more accurately known. One or two points, however, might be criticized. Thus, while referring to the information on Arab routes published by Denhardt in 1881, he makes no allusion to the similar information collected by Mr. Wakefield, and published eleven years earlier in the R.G.S. *Journal*. Again he is inclined to build too much as regards early Portuguese travels on Sanson d'Abbeville's map of 1635, since the development of that map at the hands of cartographers from 1522 onwards can be clearly traced.

Cape Colony. ———
Statistical Register of the Colony of the Cape of Good Hope for the year 1900, with Supplement partly for March Quarter, 1901, and partly for half-year ended June 30th, 1901. Cape Town: W. A. Richards & Sons, 1901. Size 13 × 8, pp. xvi. and 348. *Diagram. Presented by the Under Colonial Secretary.*

Central Africa—Kivu. *Petermanns M.* 47 (1901): 259-260. **Herrmann.**
Die Kivu-Vulkane. Briefliche Mitteilung des K. Grenzkommissars Hauptmann Herrmann.

Congo State. **Lemaire.**
Mission Scientifique du Ka-Tanga. Résultats des observations astronomiques, magnétiques et altimétriques effectuées sur le territoire de l'État Indépendant du Congo, du 4 août 1898 au 2 septembre 1900. Premier mémoire (pp. 63, *Illustrations*); Deuxième mémoire, du 4 août 1898 au 24 novembre 1898 (pp. 88); Troisième mémoire, du Mardi 10 janvier 1899 au Samedi 25 mars 1899 (pp. 70); Quatrième mémoire, du Dimanche 7 mai 1899 au Lundi 12 juin 1899 (pp. 66); Cinquième mémoire, du Mardi 13 juin 1899 au Mercredi 19 juillet 1899 (pp.

46); Sixième mémoire, du Dimanche 23 juillet 1899 au Jeudi 17 août 1899 (pp. 60); Septième mémoire, du Vendredi 18 août 1899 au Vendredi 15 septembre 1899 (pp. 58); Huitième mémoire, du Lundi 18 septembre 1899 au Samedi 14 octobre 1899 (pp. 60); Neuvième mémoire, du Samedi 21 octobre 1899 au Lundi 13 novembre 1899 (pp. 46); Dixième mémoire, du Vendredi 17 novembre 1899 au Mercredi 24 janvier 1900 (pp. 70); Onzième mémoire, du 27 janvier 1900 au 23 mars 1900 (pp. 66); Douzième mémoire, du Samedi 24 mars 1900 au vendredi 20 avril 1900 (pp. 50); Treizième mémoire, du Samedi 21 avril 1900 au Lundi 14 mai 1900 (pp. 64); Quatorzième mémoire, du Mardi 15 mai 1900 au dimanche 10 Juin 1900 (pp. 78); Quinzième mémoire, du Vendredi 15 juin au Samedi 25 août 1900 (pp. 94). Par le Capitaine Charles Lemaire. Size 13 × 10. *Presented by the Author.*

The value of Captain Lemaire's astronomical and other observations has been frequently dwelt upon in the *Journal*. The publication of the full results supplies a solid basis for the cartography of the southern portion of the Congo State.

Congo State. *B.S.G. Com. Paris* **22** (1901): 257–283. **Lemaire.**

La mission scientifique belge du Ka-Tanga. Par le Capitaine Ch. Lemaire. *With Map.*

Congo State. *Scottish G. Mag.* **17** (1901): 526–556. **Lemaire.**

On the Congo: the Belgian Scientific Expedition to Ka-Tanga. By Captain Lemaire. *With Portrait and Map.* Captain Lemaire's Itinerary.

Congo State. *Mouvement G.* **18** (1901): 643–651. ———

Compagnie du Congo pour le Commerce and l'Industrie. Assemblée générale ordinaire du Décembre 16, 1901. *With Map.*

The map shows the territories of the chief commercial companies at work in the Congo State.

Congo State. *Mouvement Géographique* **18** (1901): 607-615. ———

La Compagnie du Kasai. *With Map.*

Dahome—Railway. *Rev. Française* **26** (1901): 701–709. **Montell.**

Le chemin de fer du Dahomey. Par A. Montell. *With Map.*

East Africa—Coral-reefs. *Z. Ges. Erdk. Berlin* **36** (1901): 115-144. **Werth.**

Lebende und jungfossile Korallenriffe in Ost-Afrika. Von Dr. Emil Werth. *With Maps and Illustrations.*

East Africa—Nyasa. *Kolon. Z.* **2** (1901): 409–412. ———

Die Schirehochlandbahn und die Afrikanischen Seengebiete.

The writer considers that the fears which have been expressed, that the proposed Shire railway will have a prejudicial effect on German East Africa, are unfounded.

East and South Africa. **Schanz.**

Ost- und Süd-Africa. Von Moritz Schanz. Berlin: Wilhelm Süsserott, 1902. Size 13 × 7, pp. 458. *Illustrations. Price* 10*s.*

The writer gives a useful account of the present condition of the various European possessions in East and South Africa from his observations during a recent journey.

Egypt—Archæology. **Brodrick and Morton.**

A Concise Dictionary of Egyptian Archæology. A Handbook for Students and Travellers. By M. Brodrick and A. Anderson Morton. London: Methuen & Co., 1902. Size 7 × 5, pp. viii. and 198. *Illustrations. Price* 3*s.* 6*d. Presented by the Publishers.*

Intended as a handy book of reference for students and travellers in Egypt, containing much information on the archæology of the country in a condensed form.

Egypt—Bedawin. **Chantre.**

Les Bédouins d'Égypte. Esquisse Ethnographique et Anthopométrique. Par Ernest Chantre. Lyon: A. Rey & Cie., 1901. Size 9 × 5½, pp. 40.

Egypt—Kharga Oasis. **Ball.**

Kharga Oasis: its Topography and Geology. By John Ball, PH.D. (Survey Department, Public Works Ministry. Geological Survey Report, 1899, part ii.) Cairo, 1900. Size 11 × 7½, pp. 116. *Maps, Plans, and Illustrations.*

One of the valuable series of memoirs, of which those relating to Farafra and Dakhla have already been noticed in the *Journal*.

Egyptian Sudan. *B.S.G. Italiana* **2** (1901): 930-940. **Tappi.**
Un' escursione sul basso Sobat, lettera del padre L. Tappi al socio tenente di vascello L. Vannutelli.

Eritrea. *Riv. G. Italiana* **8** (1901): 649-653. **Mori.**
La carta dimostrativa della Colonia Eritrea e regioni adiacenti e le critiche del Prof. Guido Cora. Attilio Mori.

French Congo. *B.S.G. Com. Paris* **22** (1901): 393-400. **Rouhaud.**
La moyenne Nyanga (Congo français). Par M. Rouhaud.

French Congo. *B. Comité l'Afrique Française* **11** (1901): 295-301. ———
Dans le Haut-Oubangui. Par M. A. T. *With Map and Portraits.*

Account of recent French explorations, including those of MM. Superville and Bos referred to in the *Journal* for January (p. 89).

French Sahara—In-Salah. *C. Rd.* **134** (1902): 25-28. **Flamand.**
Sur la position géographique d'In-Salah, oasis de l'archipel Touatien (Tidikelt), Sahara central. Note de M. G. B. M. Flamand.

See note, *ante*, p. 375.

French West Africa. *B.S.G. Com. Paris* **22** (1901): 303-319. **Joalland.**
Autour du Tchad. Par M. le Capitaine Joalland. *With Map.*

French West Africa—Senegal. **Erskine.**
Trade of Senegal for the year 1900. Foreign Office, Annual No. 2725, 1901. Size $9\frac{1}{2} \times 6$, pp. 10. *Price* 1d.

French West Africa—Senegal. *C. Rd.* **134** (1902): 60-63. **Vasseur.**
Sur la découverte du terrain nummulitique dans un sondage exécuté à Saint-Louis du Sénégal. Note de M. G. Vasseur.

German East Africa. *M. Deutsch. Schutzgeb.* **14** (1901): 225-228. **Ambronn.**
Resultate der von Herrn Hauptmann Schlobach im Jahre 1898 ausgefuhrten astronomischen Ortsbestimmungen. Berechnet von Prof. Dr. Ambronn.

German East Africa. *Deutsch. Kolonialblatt* **12** (1901): 902-906. **Charisius.**
Reisebericht des Hauptmanns Charisius.

On an expedition through the steppe-regions in the northern interior of German East Africa.

German East Africa. *Z. Ges. Erdk. Berlin* **36** (1901): 152-164. **Kohlschütter.**
Die Grabenländer im Nördlichen Deutsch-Ost-Afrika. Von Dr. E. Kohlschütter.

On the results of the "Pendulum Expedition."

German Possessions—Boundaries. *Globus* **80** (1901): 387-388. **Singer.**
Der Stand der Abgrenzung unserer afrikanischen Schutzgebiete. Von H. Singer.

NORTH AMERICA.

Canada. *P. and T.R.S. Canada* **6** (1901): 99-120. **Ells.**
The Physical Features and Geology of the Palæozoic Basin between the Lower Ottawa and St. Lawrence Rivers. By R. W. Ells.

Canada. *P. and T.R.S. Canada* **6** (1900): 175-177. **Laflamme.**
Modifications remarquables causées à l'Embouchure de la Rivière Ste. Anne par l'Eboulement de St. Alban. Par J. C. K. Laflamme.

Canada. *P. and T.R.S. Canada* **6** (1900): 179-186. **Laflamme.**
Eboulement à Saint Luc-de-Vincennes, Rivière Champlain, le 21 septembre 1895. Par J. C. K. Laflamme. *With Illustrations.*

Canada—British Columbia. ———
The Year Book of British Columbia. Compendium, 1897-1901. Victoria, B.C. Size 10×7, pp. 216. *Map and Illustrations.*

Canada—British Columbia. *Alpine J.* **20** (1901): 491-504. **Stutfield.**
Mountain Travel and Climbs in British Columbia. By Hugh E. M. Stutfield. *With Illustrations.*

Describes the journey made in 1900 in company with Prof. N. Collie (*Journal*, vol. xvii. p. 252).

Canada—Geology. *P. and T.R.S. Canada* 6 (1900): 187-225. **Ami.**
Synopsis of the Geology of Canada. (Being a summary of the principal terms used in Canadian Geological Nomenclature.) By Henry M. Ami.

Canada—Labrador. *Blackwood's Mag.* 170 (1901): 688-698. **Grenfell.**
Life in Labrador. By W. T. Grenfell.

Canada—Ornithology. **Macoun.**
Geological Survey of Canada. Catalogue of Canadian Birds. Part i. Water Birds, Gallinaceous Birds, and Pigeons. Including the following orders: Pygopodes, Longipennes, Tubinares, Steganopodes, Anseres, Herodiones, Paludicolæ, Limicolæ, Gallinæ, and Columbæ. By John Macoun. Ottawa, 1900. Size 10 × 6½, pp. viii. and 218. *Presented by the Geological Survey of Canada.*

Canada—Rocky Mountains. *Travel* 6 (1901): 243-248. **Steele.**
In the Heart of the Canadian Rockies. By Louis J. Steele. *With Illustrations.*
On a journey in the Mount Assiniboine region in 1901, in which Mr. H. G. Bryant took part.

Mexico. *P. and T.R.S. Canada* 6 (1900): 205-265. **Campbell.**
Mexican Colonies from the Canary Islands traced by Language. By the Rev. John Campbell. *With Plates.*

Mexico. *B.S.G. y Estadistica Rep. Mexicana* 4 (1897): 264-269. **Noriega.**
Los progresos de la Geografia en Mexico. Por el señor Profesor Eduardo Noriega.

Mexico—Popocatepetl. *M.G. Ges. Wien* 44 (1901): 219-238. **Schmit.**
Eine Besteigung des Popocatepetl in Mexico im Jahre 1866. Von Dr. Ernst Ritter Schmit v. Tavera.

North America—Mammals. **Elliot.**
A List of the Land and Sea Mammals of North America north of Mexico. Supplement to the Synopsis. By D. G. Elliot. (Field Columbian Museum, Publication 57. Zoological Series, vol. ii. No. 2.) Chicago, 1901. Size 10 × 6½, pp. 477-522. *Plates.*

United States. *National G. Mag.* 12 (1901): 381-389. ———
The Sex, Nativity, and Colour of the People of the United States. *With Diagrams.*

United States.—California. *National G. Mag.* 12 (1901): 391-392. **Holder.**
A remarkable Salt Deposit. By Charles F. Holder. *With Illustrations.*
On the method of exploitation at Salton, California.

United States—Oregon. *J. School G.* 5 (1901): 281-289. **Russell.**
Climate, Vegetation, and Drainage of Cascade Mountains of Northern Washington. By I. C. Russell.
Abstracted from a paper by Prof. Russell, noticed in vol. xvii. of the *Journal* (p. 662).

United States—Texas. *National G. Mag.* 12 (1901): 430-432. **Baker.**
The Lost Boundary of Texas. By Marcus Baker. *With Map.*
Many of the monuments set up by Clark during his survey of the 103rd meridian in 1859-60 have disappeared, and a fresh survey is much needed.

United States—Urban Population. ———
Twelfth Census of the United States. Urban Population in 1900. (Census Bulletin, No. 70, July 11, 1901.) Size 11¾ × 9, pp. 14.
This was noticed in the *Journal* for October, 1901 (p. 445).

United States—Utah. *Scottish G. Mag.* 17 (1901): 617-644. **Talmage.**
The Great Salt Lake. By Prof. James E. Talmage, PH.D. *Map and Illustrations.*

CENTRAL AND SOUTH AMERICA.

Bolivia and Paraguay. **Quijarro.**
La Cuestión de limites entre Bolivia y el Paraguay. Documentos de la Mision confidencial desempeñada por el Doctor Antonio Quijarro en Enero de 1901. Buenos Aires, 1901. Size 8½ × 6, pp. 114. *Presented by the Author.*

British West Indies. **Walker.**
The West Indies and the Empire. Study and Travel in the Winter of 1900-1901. By H. de R. Walker. London: T. Fisher Unwin, 1901. Size 9 × 5½, pp. x. and 254. *Map. Presented by the Publisher.*

A study of the West Indian problem, based on personal investigation. While dealing largely with the position of the sugar industry, the author keeps in view the wider question of Imperial responsibility for the welfare of our West Indian colonies, and attempts to answer the question whether we have done all that is required to further that welfare.

Central America and West Indies. **Keane.**
Stanford's Compendium of Geography and Travel (New Issue), Central and South America. Vol. II. Central America and West Indies. By A. H. Keane. Edited by Sir Clements Markham, K.C.B., F.R.S. London: Edward Stanford, 1901. Size 8 × 5½, pp. xxiv. and 496. *Maps and Illustrations. Price 15s. Presented by the Publisher.*

This will be specially noticed.

Chile. *Petermanns M.* 47 (1901): 262–264. **Hammer.**
Die Messungsmethoden der chilenischen Grenzkommission. Von Prof. Dr. E. Hammer.

The writer discusses the methods of survey described in Prof. Bertrand's paper in the *Journal* for September, 1900.

Costa Rica. *B.I. Fis.-G. Costa Rica* 1 (1901): 219–222. **Pittier.**
La presión atmosférica en San José según las observaciones practicadas de 1889 á 1900 en el observatorio Meteorológico Nacional por Enrique Pittier. *With Diagram.*

Jamaica. ———
Institute of Jamaica. Jamaica in 1901: a Handbook of Information for Intending Settlers, with Notes for Visitors. Kingston, Jamaica. London: H. Sotheran & Co., 1901. Size 9 × 5½, pp. vi. and 112. *Map and Illustrations. Presented by Messrs. H. Sotheran & Co.*

Patagonia and Chile. **Stephani.**
Bihang K. Svensk. Vetens.-A. Handlingar 27 (1901): No. 6, pp. 69.
Beiträge zur Lebermoos-Flora Westpatagoniens und des südlichen Chile. Von F. Stephani. Mit einer Einleitung von P. Dusén.

South America—Palms. **Lindman.**
Bihang K. Svensk. Vetens.-A. Handlingar 26 (1901): No. 5, pp. 42.
Beiträge zur Palmen-Flora Südamerikas. Von C. A. M. Lindman. *With Plates.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Discovery. *R.G.S. Australasia (Victoria)* 19 (1901): 63–82. **Gordon.**
Did De Quiros land at Port Curtis? A Reply to Cardinal Moran. By George Gordon.

Australia—Discovery. *R.G.S. Australasia (Victoria)* 19 (1901): 39–52. **Moran.**
Was Australia discovered by De Quiros in the year 1606? Additional remarks by His Eminence Cardinal Moran. Also separate copy. Sydney and Brisbane: W. Brooks & Co., 1901.

This was referred to in the Monthly Record for March.

Australia—Discovery. *R.G.S. Australasia (Victoria)* 19 (1901): 53–62. **Sutherland.**
De Quiros and the Discovery of Australia. A Reply to Cardinal Moran. By Alexander Sutherland, M.A.

Australia—Early Voyages. **Thomson.**
R.G.S. Australasia (Victoria) 19 (1901): 85–88.
H.M.S. *Lady Nelson.* By Captain Wm. Campbell Thomson. *With Illustration.*

It was one of the boats of the *Lady Nelson* that first discovered and entered Port Phillip.

Australia—Water Supply. *J.R. Colonial I.* 33 (1901–2): 40–54. **Cox.**
The Water Supply of Australia. By W. Gibbons Cox.

Fiji. **Vaughan.**
Fiji. Meteorological Observations taken at Siwa during 1900. By J. D. W. Vaughan. Siwa: E. J. March, 1901. Size 13 × 8½, pp. 16.

German New Guinea. *M. Deutsch. Schutzgeb.* 14 (1901): 229–241. **Schnee.**
Ueber Ortsnamen im Bismarck-Archipel. Von Bezirksrichter Dr. Schnee. *Map.*

New Guinea. **Niermeyer.**
Tijds. K. Ned. Aard. Genoots. Amsterdam **18** (1901): 956–962.

De Zuidkust van Nieuw-Guinea. Door J. F. Niermeyer.

New Zealand. **Barron.**

Report of the Department of Lands and Survey, New Zealand, for the year 1900–1901. By Alexander Barron, Assistant Surveyor-General. Wellington, 1901. Size 13 × 8½, pp. xxvi. and 306. *Maps, Plans, and Illustrations.*

See note in February *Journal* (p. 221).

New Zealand—Historical. *J. Polynesian S.* **10** (1901): 107–165. **Best.**

Te Whanga-Nui-A-Tara. Wellington in Pre-Pakeha Days. By Elsdon Best.

On Maori traditions and their bearing on the question of the first peopling of New Zealand.

Pacific. *R.G.S. Australasia (Victoria)* **19** (1901) : 17–29. **Chewings.**

Amongst Tropical Islands. By Miss Hannah Chewings. *Map and Illustrations.*

Pacific. *National G. Mag.* **12** (1901): 413–429. **Langley.**

Diary of a Voyage from San Francisco to Tahiti and Return, 1901. By S. P. Langley. *With Maps and Illustrations.*

Pitcairn Island. ———

Further Correspondence relating to the Condition of the Pitcairn Islanders. London: Eyre & Spottiswoode, 1901. Size 13 × 8¼, pp. 8. *Price* 1d.

Queensland. **Dixon.**

Index to Names of Places, Mines, Reefs, etc., occurring in the Geological Survey Reports, Queensland. Nos. 1 to 134 (inclusive). By Russell Dixon. Brisbane, 1901. Size 13½ × 8½, pp. 26.

POLAR REGIONS.

Antarctic—Belgian Expedition. *Ann. G.* **10** (1901): 454–461. **Zimmermann.**

Quelques résultats de l'expedition antarctique belge. Par Maurice Zimmermann.

Antarctic—German Expedition. *Petermanns M.* **47** (1901): 231–233. **Drygalski.**

Die deutsche Südpolar-Expedition, Erster Bericht. Von Professor Dr. E. v. Drygalski.

See note in *Journal* for January (p. 97).

Antarctic—German Expedition. **[Drygalski.]**
Verh. Ges. Erdk. Berlin **28** (1901): 422–428.

Erster Bericht des Leiters der Deutschen Südpolar-Expedition.

Arctic—Bear Island. **Cleve.**
Bihang K. Svensk. Vetens. A. Handlingar **26** (1901): No. 10, pp. 25.

Beiträge zur Flora der Bären-Insel. I. Die Diatomeen. Von Astrid Cleve.

Arctic—Bear Island. **Swenander.**
Bihang K. Svensk. Vetens. A. Handlingar **26** (1901): No. 3, pp. 50.

Beiträge zur Fauna der Bären-Insel. I. Die Vögel. Von G. Swenander. *With Map and Plates.*

Papers on other sections of the Flora and Fauna appear in the same volume.

Arctic—Crustacea. **Ohlin.**
Bihang K. Svensk. Vetens. A. Handlingar **26** (1901) : No. 12, pp. 54.

Arctic Crustacea collected during the Swedish Arctic Expeditions, 1898 and 1899, under the direction of Professor A. G. Nathorst. I. Leptostraca, Isopoda, Cumacea. By Axel Ohlin. *With Plates.*

Arctic—Franz Josef Land. *P.R. Dublin S.* **9** (1900): 271–282. **Carpenter.**

Collembola from Franz-Josef Land. (Collected by Mr. W. S. Bruce, 1896–97.) By George H. Carpenter, B.SC. Pantopoda from the Arctic Seas. (Dredged by Mr. W. S. Bruce, 1897–98.) By George H. Carpenter, B.SC.

Arctic—Jan Mayen. **Dusén.**
Bihang K. Svensk. Vetens. A. Handlingar **26** (1901): No. 13, pp. 16.

Beiträge zur Flora der Insel Jan Mayen. Von P. Dusén. *With Plate.*

Polar Exploration. *Globus* **81** (1902): 21-26. **Singer.**
Die Polarforschung im Jahre 1901. Von H. Singer.

Polar Regions. *P. Philosoph. S. Glasgow* **32** (1900-1901): 1-12. **Bruce.**
Arctic and Antarctic. By William S. Bruce. *With Illustrations.*

Spitsbergen. **Carlheim-Gyllensköld.**
Bihang K. Svensk. Vetens. A. Handlingar **26** (1901): No. 4, pp. 54.
Travaux de l'expédition suédoise au Spitzberg en 1898 pour la mésure d'un arc du méridien. Par V. Carlheim-Gyllensköld. No. 4. Déterminations de latitudes et de longitudes.

Spitsbergen and Bear Island. **Andersson and Hesselman.**
Bihang K. Svensk. Vetens. A. Handlingar **26** (1901): No. 1, pp. 88.
Bidrag till Kännedomen om Spetsbergens och Beeren Eilands Kärlväxtflora, grundade på iakttagelser under 1898 års svenska polarexpedition. Af Gunnar Andersson och Henrik Hesselman. *With Plates.*

MATHEMATICAL GEOGRAPHY.

Precession. *P.R. Irish A.* **6** (1901): 450-456. **Close.**
Hipparchus and the Precession of the Equinoxes. By Rev. Maxwell H. Close.

Surveys. *Z. Ges. Erdk. Berlin* **36** (1901): 145-151. **Stavenhagen**
Über die englische Landesaufnahme in Europe und Vorder-Indien. Von W. Stavenhagen.

Surveys—Levelling. *A.I. Técnico é Industrial Peru*, **No. 5** (1901): 5-37. **Blume.**
Sociedad Nacional de Ingenieros Año 1901. Ajuste de los Instrumentos de nivelar. Por el ingeniero Federico Blume.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geology. *P.R. Dublin S.* **9** (1900): 325-332. **Joly.**
On the Inner Mechanism of Sedimentation. (Preliminary Note.) By J. Joly, D.SC.

Geology—Wind-Action. **Credner.**
Bericht Ges. Völker- u. Erdk. Stettin (1899-1900): 30-35.
Ueber die geologischen Wirkungen des Windes. Von Professor Dr. Credner.

Geomorphology—Fiords. *J. School. G.* **5** (1901): 326-333. **Hubbard.**
Fiords. By George D. Hubbard.

Glacial Epoch. *Ciel et Terre* **22** (1901): 27-65. **Arçtowski.**
A propos de la question du climat des temps glaciaires. Par H. Arçtowski.

Glaciers—Moraines. *Abh. K.K.G. Ges. Wien* **3** (1901): (Nr. 4): pp. 334. **Böhm.**
Geschichte der Moränenkunde Von Dr. August Böhm Edlen von Böhmersheim. *With Plates. Also separate copy.*

The larger part of this work consists of a historical *résumé* of research on the subject of moraines. This is followed by an account of the discussion at the glacier conference of 1899, and a statement of the author's views as to the classification and nomenclature of moraines, which differ considerably from those adopted at the conference. A bibliography of 650 books and papers on moraines is added.

Ice-Caves. *Nat. G. Mag.* **12** (1901): 433-434. **McGee.**
Ice-Caves and Frozen Wells. By W-J McGee.

After referring to Mr. Kimball's paper on this subject (cf. *ante*, p. 220), the writer points out the need for observation of the allied phenomena of "blowing caves," "breathing wells," etc.

Limnology. *Bericht Ges. Völker- u. Erdk. Stettin* (1899-1900): 15-18. **Halbfass.**
Einige Kapitel aus der modernen Seeenforschung. Von Dr. Halbfass.

On the modern development of limnological research.

Meteorology—Snow. *Meteorolog. Z.* **18** (1901): 567-570. **Westmann.**
Einige Beobachtungen über das Schwinden einer Schneedecke. Von Dr. J. Westmann.

Oceanography. *Deutsche G. Blätter* **24** (1901): 96-174. **Krug.**
Die Kartographie der Meeresströmungen in ihren Beziehungen zur Entwickelung der Meereskunde. Von Martha Krug.

Oceanography. **Thoulet and Studer.**

Résultats des Campagnes scientifiques accomplies sur son yacht par Albert I[er] Prince Souverain de Monaco, publiés sous sa direction avec le concours de M. Jules Richard. Fasc. xix., Étude de fonds marins provenant du voisinage des Açores et de la portion orientale de l'Atlantique nord, par J. Thoulet (pp. 66). Fasc. xx., Alcyonaires provenant des Campagnes de l'*Hirondelle* (1886–1888), par Th. Studer. 1901. Size 14 × 11, pp. 64. *Plates. Presented by H.S.H. the Prince of Monaco.*

Oceanography. *Rev. Scientifique* **16** (1901): 737–741. **Thoulet.**

La transparence et la couleur de la mer. Par M. J. Thoulet.

Oceanography—Atlantic Ocean. **Cleve, Ekman, and Pettersson.**

Les variations Annuelles de l'eau de surface de l'Océan Atlantique. Par P. T. Cleve, G. Ekman, O. Pettersson. Göteborg: Bonniers Tryckeri Aktiebolag, 1901. Size 18 × 12½. *Charts and Diagrams.*

This is noticed elsewhere (*ante*, p. 358).

Oceanography—Methods. *Rev. Maritime* **151** (1901): 2207–2212. **Thoulet.**

Sur le mode de récolte des échantillons du sol sous-marin. Par J. Thoulet.

River-Capture. *C. Rd.* **133** (1901): 961–963. **Fournier.**

Les phénomènes de capture des cours d'eau superficiels par les cours d'eau souterrains, dans les régions calcaires. Note de M. E. Fournier.

This is noticed in the Monthly Record.

Rivers and Lakes. *B.S.G. Lille* **36** (1901): 385–392. **Quarré-Reybourbon.**

Un Manuscrit géographique du XVIII[e] siècle. Par L. Quarré-Reybourbon.

The manuscript, by F. C. de Venasque (1766), forms a hydrographical dictionary of the rivers and lakes of the world.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Agriculture. *Ann. G.* **10** (1901): 385–400. **Hitier.**

L'évolution de l'agriculture. Par Henri Hitier.

Anthropogeography. *Popular Science Monthly* **60** (1901): 158–165. **Clayton.**

The Influence of Rainfall on Commerce and Politics. By H. Helm Clayton.

Anthropology. *Scottish G. Mag.* **17** (1901): 569–574. **Dingelstedt.**

Anthropological Investigations in the Alps and the Caucasus. By Victor Dingelstedt.

Anthropology. **Hutchinson and Others.**

The Living Races of Mankind. A popular illustrated account of the customs, habits, pursuits, feasts, and ceremonies of the Races of Mankind throughout the world. By H. N. Hutchinson, J. W. Gregory, R. Lydekker, assisted by eminent specialists. London: Hutchinson & Co. [Not dated.] Size 11 × 8½, pp. 8, viii., and 584. *Maps and Illustrations. Presented by the Publishers.*

This work will be useful as supplying to the general public a comprehensive account of the various races of mankind, brought together from the writings of the best-known travellers and anthropologists. It is remarkable for the very extensive series of illustrations, all from photographs, which will be of value to students as well as the class of readers for which the work is primarily intended. The work is in the main descriptive, and disputed questions as to the origin and affinities of the races are very briefly touched upon, if alluded to at all. Thus the opening chapter starts at once with a description of the Polynesians, without any general treatment of the broad problems of anthropology, while in describing the races of Europe, the authors give no introductory sketch of the problems of classification, on which recent research has thrown so much light. The book is therefore to be regarded as supplementary to more systematic treatises rather than as complete in itself.

Colonization—Methods. ———

Treasury Department.—Bureau of Statistics, Colonial Administration, 1800–1900. Methods of Government and Development adopted by the principal Colonizing Nations in their control of Tropical and other Colonies and Dependencies, with Statistical Statements of the Area, Population, Commerce, Revenue, etc., of each of the World's Colonies. Including Bibliography of Colonies and Colonization prepared by the Library of Congress. (From the Summary of Commerce and Finance for October, 1901.) Washington, 1901. Size 11½ × 9½, pp 1199–1631. *Map.*

Commercial Geography. *P. American Philosoph. S.* 40 (1901): 62–85. **Haupt.**
Methods of Improving Ocean Bars. By Lewis M. Haupt.

Commercial Geography—Gold. **Servigny.**
Rev. Française 26 (1901): 407–419, 455–465.
L'or dans le Monde. Par J. Servigny. *With Maps and Illustrations.*

Commercial Geography—Maps. **Friedrich.**
Die Anwendung der Kartographischen Darstellungsmittel auf wirtschaftsgeographischen Karten. Von Ernst Friedrich. Leipzig: J. C. Hinrichs, 1901. Size 10 × 7½, pp. 30. *Map. Presented by the Publisher.*

The author, who is engaged in the preparation of a commercial map of Africa on the scale of 1 : 10,000,000, here discusses the methods to be recommended for such maps.

BIOGRAPHY.

Déchy. *Deutsche Rundschau G.* 24 (1901): 84–88. ———
Moriz v. Déchy. *With Portrait.*

Kingsley. **Hayford.**
Mary H. Kingsley from an African Standpoint. By Rev. Mark C. Hayford. London: Bear & Taylor. [1901.] Size 7 × 5, pp. 16. *Portrait. Price 2d. Presented by the Author.*

Negreiros. ———
M. Almada Negreiros, Géographe et Littérateur Portugais. *With Portrait.* (From *Les Actualités Diplomatiques and Coloniales*, Sept.-Octobre, 1901, pp. 206–208.) Size 11 × 7½.

Nordenskiöld. *Deutsche Rundschau G.* 24 (1901): 88–90. ———
Adolf Erik Freiherr v. Nordenskiöld. *With Portrait.*

Orleans. *Rev. Française* 26 (1901): 546–550. ———
Mort du Prince Henri d'Orléans. *With Portrait.*

Torquatus. *M.V. Erdk. Halle a. S.* (1901): 17–45. **Berg.**
Georg Torquatus als ältester Halberstädter Topograph (1574). Von A. Berg.

GENERAL.

Balloon Ascents—Respiration. *C. Rd.* 133 (1901): 949–951. **Tissot and Hallion.**
Les phénomènes physiques et chimiques de la respiration à différentes altitudes, pendant une ascension en ballon. Note de MM. J. Tissot et Hallion.

Ballooning. *Rev. Française* 27 (1902): 1–24. **De la Vaulx.**
L'aéronautique maritime: la traversée du "Mediterranean." Par Cte Henry de la Vaulx. *With Map and Illustration.*

British Empire. ———
The Harmony of the Empire: being a Series of Sketches in Pictorial Geography of the British Possessions and Spheres of Influence. For Schools and General Reading. Manchester: A. Heywood & Son, 1901. Size 7½ × 5, pp. xiii. and 310. *Presented by the Publishers.*

An attempt to present the political and historical geography of the British Empire in a picturesque form for the use of schools. The book is intended to supplement rather than to supersede existing text-books, and should be useful for the purpose of interesting scholars in the history of the growth and development of the Empire.

French Colonies. ———
Ministère des Colonies, Office Colonial. Statistiques Coloniales pour l'Année 1899. Commerce. Melun, 1901. Size 9½ × 6, pp. xiv. and 950. *Presented by the French Colonial Office.*

German Colonies. **Fitzner.**
Deutsches Kolonial-Handbuch. Nach amtlichen Quellen bearbeitet von Dr. Rudolf Fitzner. Band I. (pp. viii. and 412): Band II. (pp. iv. and 272). 2, erweiterte Auflage. Berlin: Hermann Paetel, 1901. Size 9 × 6. *Maps.*

In this, the second edition, Dr. Fitzner's valuable work of reference with regard to the German colonies has been much extended, and forms an indispensable compendium of information.

Madrid Geographical Society—Catalogue. **Rózpide.**
B.R.S.G. Madrid (1901): pp. 198.
Repertorio de Publicaciones y Tareas de la Sociedad Geográfica de Madrid (1876–1900). Por Ricardo Beltrán y Rózpide.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

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England and Wales. **Ordnance Survey.**

ORDNANCE SURVEY OF ENGLAND AND WALES:—Revised sheets published by the Director-General of the Ordnance Survey, Southampton, from February 1 to 28, 1902.

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England and Wales. **Bartholomew.**

Reduced Ordnance Survey of Windermere and Morecambe bay, coloured, for tourists and cyclists. Scale 1 : 63,360 or 1 stat. mile to an inch. Edinburgh: J. Bartholomew & Co., 1902. *Price 2s. mounted on cloth. Presented by the Publishers.*

A good map for tourists and cyclists. In style of production, it resembles Bartholomew's 2 miles to the inch maps of England and Wales, showing relief by contour lines and colour tinting. Driving and cycling roads are shown in red, and clearly distinguished from footpaths; railways are indicated in black. Contour lines give the depths of the lakes, evidently from the surveys of Dr. H. R. Mill.

Germany. **Hansen.**

Rüstringen und Wangerland am Jadebusen. Von R. Hansen. Scale 1 : 150,000 or 2·4 stat. miles to an inch. *Petermanns Geographische Mitteilungen, Jahrgang*, 1902, Tafel 4. Gotha: Justus Perthes. *Presented by the Publishers.*

Germany. **Krauss.**

Radfahrer-Uebersichtskarte von Deutschland und den benachbarten Ländern, herausgegeben vom Deutschen Radfahrer-Bunde. Bearbeitet von P. Krauss.

Scale 1 : 850,000 or 11·8 stat. miles to an inch. Sheets: 2, 4, 6. Bibliographisches Institut, Leipzig.

With these three sheets this road-map of Germany is complete. Main roads are shown in red, and red figures indicate the distance between the principal towns through which these roads pass.

AFRICA.

Central Africa. **Moisel.**

Dr. F. Stuhlmann's Aufnahmen im Gebiet des Albert- und Albert-Edward-Sees, während der Emin Pascha-Expedition, Mai 1891 bis Januar 1892. Konstruirt und gezeichnet von Max Moisel. Scale 1 : 300,000 or 4·7 stat. miles to an inch. *Mittheilungen der Geogr. Gesellschaft in Hamburg*, xvii., Kartes 1 A and B. Hamburg: L. Friederichsen & Co., 1901. *Two Sheets and Letterpress.*

Although ten years have elapsed since the journey of Dr. A. Stuhlmann was undertaken, and although the narrative of his expedition was published some time ago, yet until this map appeared, the complete and detailed results of his surveys had not been published. Now that our knowledge of the region between Albert Edward Nyanza and Albert Nyanza has been considerably extended by more recent explorations, it has been considered advisable to compile a map of the whole region, combining the surveys of other explorers with those of Dr. Stuhlmann, whose routes extended from the western shores of Albert Edward Nyanza, in a northerly direction, to the country to the north-west of Albert Nyanza, as well as to the Ruwenzori range. The original documents of Dr. Stuhlmann, which have been made use of in the compilation of this map, include, amongst others, route-survey books, seventy-five sheets of profiles and sections, astronomical observations for fixing the latitude and longitude of places and variation of compass, and aneroid observations for altitudes. These have been utilized in the preparation of this map, which has been plotted with great care, in the first place on a large scale, and then reduced. In the letterpress which accompanies the map, Herr Max Moisel gives a list of Dr. Stuhlmann's own documents, and the latitudes and longitudes of places fixed by him, as well as of the maps and observations of other explorers which he has made use of. He gives also his authority in adopting the position of certain places shown upon the map. Although he has not overlooked the surveys of Mr. M. Fergusson, of Mr. Moore's expedition, published in the *Geographical Journal* for June, 1901, it is rather surprising that he has not followed him in the delineation of the northern shore of Albert Edward Nyanza, and there are one or two other points that are perhaps open to criticism. However, this is a most useful map, if only from the fact that we now have Dr. Stuhlmann's survey work of this region published on a scale that is large enough to be serviceable.

Congo Free State. **Langhans.**

Spezialkarte von Marungu und Utembue. Nach neueren Aufnahmen der Weissen Väter (Apostolisches Vikariat der Obern Kongo), entworfen von Paul Langhans. Scale 1 : 300,000 or 4·7 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1902, Tafel 2. Gotha: J. Perthes. *Presented by the Publisher.*

Includes the district round Baudouinville, on the western shore of Lake Tanganyika, between 6° 20′ and 7° 40′ S. lat., and 29° 10′ and 30° E. long. Notes on the character of the country are given, and the geology of certain localities indicated by means of colouring. Travellers' routes are also shown.

South Africa. **Favre.**

Carte du Théatre de la Guerre Sud Africaine, par le Col. Camille Favre. Scale 1 : 1,600,000 or 25·3 stat. miles to an inch. Genèvé: Librairie Georg & Co., 1902. *Presented by the Author.*

This is a general map of the eastern and central part of South Africa, published to illustrate the military operations. The scale is somewhat small, but a good deal of information is given, and the names of places rendered important by recent battles are indicated. It is printed in colours, and contains two insets.

South Africa. **Johnston.**

Special map of South Africa. Scale 1 : 2,661,120 or 42 stat. miles to an inch. Edinburgh and London: W. & A. K. Johnston, 1902. *Price 1s. Presented by the Publishers.*

One of the numerous cheap popular maps of South Africa that have been published lately to illustrate the military operations. The names of important places are underlined in red, and sites of battles are shown. In addition to the principal map there are several insets.

AMERICA.

Nicaragua. **Nicaragua Canal Commission.**

Tiefenkarte des Nicaragua-Sees, nach den Aufnahmen der Nikaraguakanal-Kommission. Scale 1 : 400,000 or 6·3 stat. miles to an inch.—Geologische Profile zwischen dem Karibischen Meer und dem Grossen Ozean längs der Kanallinien. *Petermanns Geographische Mitteilungen*, Jahrgang 1902, Tafel 3. Gotha: Justus Perthes. *Presented by the Publisher.*

South America. **Stübel.**

Geographische Verbreitung der hauptsächlichsten Eruptionszentren und der sie Kennzeichnenden Vulkanberge in Südamerika. Scale 1 : 10,000,000 or 158 stat. miles to an inch. Von A. Stübel. *Petermanns Geographische Mitteilungen*, Jahrgang 1902, Tafel 1. Gotha: Justus Perthes. *Presented by the Publisher.*

Dr. Stübel has shown on this diagram, or sketch-map, which includes the whole of the Andes from Panama to Tierra del Fuego, the position of the principal centres of eruption and volcanoes, which he has arranged into the following general divisions: (A) The Colombia-Equadorian; (B) the Peru-Bolivian; (C) the Central Chilian; and (D) the Patagonian. The first two of these are again subdivided in smaller groups, each of which is encircled by a red line and bears a certain number, as does also each separate volcano. By means of these numbers and an index which is given on the map, the name of several groups and separate volcanoes can readily be found. Those volcanoes which have been in active eruption during the nineteenth century are distinguished by a red mark in the centre, and by having their names printed in a different type in the index. The map accompanies an interesting paper by Dr. A. Stübel in the January number of *Petermanns Mitteilungen* for this year.

United States. **Rand, McNally & Co.**

Indexed County and Township Pocket Maps of Idaho. Scale 1 : 1,647,360 or 26 stat. miles to an inch, and Georgia. Scale 1: 950,200 or 15 stat. miles to an inch. Chicago and New York: Rand, McNally & Co., 1901. *Price* $0·25 *each. Presented by the Publishers.*

These are new editions of Rand, McNally & Co.'s useful little indexed maps of the United States. They are, however, very rough productions.

PACIFIC OCEAN.

Hawaiian Islands. **Rand, McNally & Co.**

Indexed Pocket Map of the Hawaiian Islands. Scale 1 : 1,330,560 or 21 stat. miles to an inch. Chicago and New York: Rand, McNally & Co. *Presented by the Publishers.*

Drawn on too small a scale for anything but very general purposes; however, it shows steamer routes and distances to various Pacific ports. Many of the names are very indistinct.

GENERAL.

Ancient Geography. **Kiepert.**

Formæ Orbis Antiqui. 36 Karten im Format von 52 : 64 cm. mit kritischem Text und Quellenangabe zu jeder Karte. No. XX. Italiæ Pars Media. Mit 8 Seiten Text. Ergänzt und herausgegeben von Richard Kiepert. Berlin: D. Reimer (Ernst Vohsen), 1902. *Price* 3 *marks.*

Eight maps are now published out of a total number of thirty-six, which this atlas will contain altogether. Those previously issued are No. IX. Asia provincia (citerior); XII. Insulæ maris Ægaei; XV. Græcia septentrionalis; XVII. Illyricum et Thracia; XIX. Italia inferior cum insulis; XXVI. Insulæ Britannicæ; XXVII. Hispania. The map of central Italy, which appears in this part, is on the scale of 1: 800,000, and contains much useful historical information. In addition to the principal map, there are insets, and eight pages of descriptive letterpress. The atlas is now published in separate sheets as they are ready, at three marks each, instead of delaying the publication for several sheets to be ready to make up a part.

World. **Stieler.**

Neue, neunte Lieferungs-Ausgabe von Stielers Hand-Atlas, 100 Karten in Kupferstich. 3 Lieferung. Gotha: Justus Perthes. *Price* 60 *pf.*

This part contains two maps, each of which is quite new. No. 14, Switzerland, is the western sheet of a new two-sheet map which is to embrace the whole of the Alps, drawn on the scale of 1: 925,000, by Messrs. C. Scherrer and H. Habenicht. No. 40 is a map of the Netherlands, Belgium, and Luxemburg, drawn by C. Scherrer, on the scale of 1 : 1,110,000. This latter contains insets, on enlarged scales, of Amsterdam, Brussels, and the coal-mining district of Mons and Charleroi. The natural scales of the maps in this part are certainly remarkable, and it is difficult to see why they have been

selected instead of even multiples of a million. Possibly the size of the sheet has had something to do with the matter, but surely the difficulty could have been obviated, if by no other means, by slightly altering the areas included. However, the maps are both well executed, and will doubtless prove very useful for general reference.

CHARTS.

Danish Chart. **Danish Admiralty.**

No. 147, Grönland med omgivelser. Scale 1 : 1,900,000 or 30 stat. miles to an inch. Sökaart Archiv, Kjöbenhavn, 1902. 2 sheets. *Presented by the Danish Admiralty.*

North Atlantic Ocean and Mediterranean Sea. **Meteorological Office, London.**

Pilot Chart of the North Atlantic and Mediterranean for March, 1902. London: Meteorological Office. *Price 6d. Presented by the Meteorological Office.*

U.S. Charts. **U.S. Hydrographic Office.**

Pilot Charts of the North Atlantic Ocean for February, and North Pacific Ocean for March, 1902. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Alaska and British Columbia. **Cook.**

Nine Photographs of Alaska and British Columbia. By W. H. Cook, Esq. 1898. *Presented by W. H. Cook, Esq.*

Enlarged from snap-shots taken by Mr. W. H. Cook while on a voyage round the world in 1898. The titles are as follows:—

(1) Yakutat, near Mount St. Elias; (2) Dutch harbour; (3–4) Glaciers near Cross sound; (5, 6) Snow-capped mountains near Chatham straits; (7) Bella Bella, Indian playground; (8) Snow-capped mountains near Pitt island; (9) Coast view near Pitt island.

Algerian Sahara. **King.**

Fifty-three Photographs of the Algerian Sahara between Biskra, El Wad, and Wargla. By W. J. Harding King, Esq. *Presented by W. J. Harding King, Esq.*

This is a set of "Kodak" photographs. Most of them are very clear, and, as will be seen from the titles, the subjects are of ethnological and geographical interest.

(1, 2) A Hoggar Tuareg (a noble); (3) Group of Tuaregs; (4) A Tuareg eating dates; (5) Tuareg tent; (6) Tuareg sheikh on camel; (7, 8) Tuareg camp; (9) Cemetery of caravan murdered by Tuaregs; (10) Tent of Tuareg chief; (11) El Wad from minaret of mosque; (12) Palms planted in hollow between dunes, El Wad; (13) The market, El Wad; (14) Among the sand-dunes, near El Wad; (15) Palm groves near El Wad, from minaret of mosque; (16) Tobacco plantation near El Wad; (17) A "guemeerah," artificial land-mark near El Wad; (18) Among the sand-dunes, near El Wad (land-mark in distance); (19) Interior of mosque, Tugurt; (20, 21) The market, Tugurt; (22) Scorpion-proof bedstead, Tugurt; (23, 24) Street in Tugurt; (25) Water-carrier, Tugurt; (26) A Jew of Tugurt; (27) Dyers at work in market, Tugurt; (28) Tombs of the Beni Jellab, old sultans of Tugurt; (29) Well between Tugurt and Wargla; (30) Camel postmen between Tugurt and El Wad; (31) Between Tugurt and El Wad: bushes thrown up by side of road to act as "guemeerahs" (land-marks); (32) One of the gates at Wargla; (33) A "khottara" well near Wargla; (34) Man carrying water in basket of plaited grass, Wargla; (35) Market square, Wargla; (36) Court of a mosque, Wargla; (37) Wargla from a minaret of mosque; (38) Street in Wargla; (39) Interior of native house, Wargla; (40) Courtyard in Zawia monastery of Temalatta; (41) Moat and wall of Temassin; (42) A Ronara girl, inhabitant of Wad Khirh oasis; (43) Cairn marking grave of murdered man; (44) A desert mosque; (45) Stalking gazelle with a camel; (46) Stalking gazelle with a camel: the signal for the camel to turn; (47) Moat and wall of N'goussa; (48) Watch-tower on wall of palm plantation, Filiash oasis, near Biskra; (49) The "bordj," caravanserai, of Setil; (50) The "bordj" of M'raier; (51) Wedding dance at M'raier; (52) Marabut's tomb near M'raier; (53) Market square, M'raier; (54) Ronara woman from M'raier.

Ashanti. **Fergusson.**

Eleven Photographs of Ashanti, by Malcolm Fergusson, Esq. *Presented by Malcolm Fergusson, Esq.*

Taken by Mr. Fergusson during his explorations in the neighbourhood of Lake Busumchwi, described in the *Geographical Journal* for last month:—

(1, 2) Lake Busumchwi; (3) Fisherman, Lake Busumchwi; (4, 5) Boy returning from fishing, Lake Busumchwi; (6) Crossing a creek, Lake Busumchwi; (7) Submerged

trees, showing rapid rise in Lake Bosumchwi; (8) Market-place and scaffold, Kumasi; (9, 10) Villages on Kumasi road; (11) Rubber-carriers going to the coast.

Bahamas. **Coonley, Davenport, and Mancle.**

One hundred and nineteen Photographs of the Bahamas, by Messrs. Coonley, Davenport, and Mancel. *Presented by the Colonial Office Library.*

These photographs form a valuable and welcome addition to the Society's collection. They are of different sizes, and vary considerably in merit. A few of them are stereoscopic views. The titles are as follows:—

(1) Central and Western view of Nassau from cathedral tower; (2) Central view of Nassau from the harbour; (3) North-west view of Nassau; (4) North-east view of Nassau from Government House; (5) Nassau harbour from Water battery; (6, 7) Nassau harbour; (8–10) Barracks and harbour; (11) Entrance to harbour, from Government House; (12) Wharves and harbour; (13) Entrance to harbour, Silver cay in distance; (14) Unloading sponges, Nassau; (15) Fishing-boats, Nassau harbour; (16) St. George's Club boats; (17) Barque *Maggie* stranded on Tony rock bar, mouth of Nassau harbour; (18) Fishing-boats undergoing repair; (19) Mail steamer *San Jacinto*; (20–22) Government House, Nassau; (23) Statue of Columbus, Nassau; (24, 25) Military Barracks, Nassau; (26) Town Parade; (27, 28) Officers' quarters; (29) View in Ordnance yard, Nassau; (30) Military hospital, Nassau; (31) Commissary, Nassau; (32) Eastern Parade and Fire Engine Company, Nassau; (33) Residences of attorney-general, bishop, etc.; (34–36) Public buildings, Nassau; (37, 38) Silk-cotton tree near public buildings, Nassau; (39) Silk-cotton tree by police barracks, Nassau; (40) Public Library, Nassau; (41) Robinson Gardens (Library grounds), Nassau; (42) Prison, Nassau; (43) Fort Fincastle and old quarry, Nassau; (44, 45) Queen's staircase near Fort Fincastle, Nassau; (46) Interior of cathedral, George Street, Nassau; (47) Christ Church Cathedral, Nassau; (48) Christ Church rectory, Nassau; (49) St. Matthew's Church, near Nassau; (50, 51) St. Mary's Church, Nassau; (52) Presbyterian Church, Nassau; (53) Methodist Chapel, Nassau; (54) St. Andrew's Hall and Kirk, Nassau; (55, 56) Royal Victoria Hotel, Nassau; (57) Silk-cotton tree in Royal Victoria Hotel grounds, Nassau; (58) Gregory Arch near Government grounds; (59–64) Bay Street, Nassau; (65) Vendue House, Bay Street, Nassau; (66) Cottages in East Bay Street, Nassau; (67) Cocoanut grove; (68) Cumberland Street, Nassau; (69–71) Dowdeswell Street, Nassau; (72, 73) East Street, Nassau; (74–76) George Street, Nassau; (77) Matthew Avenue, Nassau; (78) Shirley Street, Nassau; (79) View from Shirley Street, looking north, Nassau; (80) Union Street, Nassau; (81) Market, Nassau; (82) Tropical types of buildings; (83) Fleming Square, Nassau; (84) Centreville; (85) View on Sandilands road; (86) School at Sandilands; (87) Asylum, New Providence islands; (88) Lepers' ward, New Providence Asylum; (89) "The Hermitage;" (90) Cunningham lake; (91) Negro hut; (92) Rural scene; (93) Banyan tree; (94) Salt bay; (95) Alley in Grant's Town; (96) Grant's Town cottage; (97) Negro group, Grant's Town; (98) View of Port Howe, Cat island; (99) Festival scene, August 1, Eleuthera; (100) View at Spanish wells, Eleuthera; (101) The Cove settlement, Eleuthera; (102) St. John's Church, Harbour island; (103) Wesleyan Chapel, Harbour island; (104) Views from wharf, looking west, Harbour island; (105) View from the Mission House, looking south-west, Harbour island; (106) View from the school house, Harbour island; (107) Bay Street, looking east, Harbour island; (108) Howelton, Hog island; (109, 110) Hog island lighthouse; (111, 112) Gregory Street, Inagua; (113, 114) View at Inagua; (115) Kortwright Street, Inagua; (116) Shipping salt, Inagua.

Bulgaria. **Buxton.**

Twenty-two Photographs of Bulgaria. By Noel Edward Buxton, Esq. *Presented by Noel Edward Buxton, Esq.*

The greater number of these photographs illustrate the dwellings and life of the inhabitants. The following is a list of the titles:—

(1) Petha Karaveloff (prime minister of Bulgaria) and his family; (2) Entrance to Rilo: (3–8) Rilo monastery; (9) Hermit's chapel at Rilo; (10) Frescoes at Rilo chapel; (11, 12) Peasants at Trojan fair; (13) Wool fair at Trojan; (14, 15) Monastery of Trojan; (16, 17) Peasants at Tirnova; (18) Protestant school at Samakov; (19) School-children from Samakov, at Chamkouria; (20) School-children at Chamkouria; (21) Rushchuk from the Danube; (22) A team of bullocks resting at midday.

England—River Trent. **Weller.**

Six Photographs of the "Aegir" on the Trent at Gainsborough. By C. L. Weller, Esq. 1901. *Presented by C. L. Weller, Esq.*

An interesting set of photographs illustrating the bore, or "aegir," as it is called, of the Trent.

(1) Wave coming up-stream; (2) Wave breaking over a shallow; (3) Wave dashing against the bridge; (4) Wave passing the bridge; (5) The "whelps," or small waves that follow the "aegir;" (6) Boats among the "whelps."

Hong-Kong. **Hurley.**

Sixty Photographs of Hong-Kong. By H. C. Hurley, Esq., 1897. *Presented by the Colonial Office Library.*

An album of photographs published in Hong-Kong in 1897 to celebrate the Diamond Jubilee of her late Majesty Queen Victoria. Their titles are as follows:

(1) The island in 1837; (2) Possession point, British flag hoisted Jan. 25, 1841; (3) Murray battery, erected to cover the city, 1845; (4) Hong-Kong, 1897; (5) The city of Victoria, 1897; (6) Government house; (7) Headquarters house; (8) St. John's Cathedral; (9) The Roman Catholic Cathedral (Church of the Immaculate Conception); (10) The City Hall; (11) Fountain erected by John Dent, Esq.; (12) Hong-Kong and Shanghai bank; (13) Government civil hospital; (14) St. Paul's College; (15) The Berlin foundling house; (16) Queen's College; (17) Belilios public school; (18) Government offices; (19) The Hong-Kong club; (20) The central market; (21) Market boats; (22) The Praya reclamation; (23) Cargo boats; (24) The public gardens, from the east; (25) The public gardens, from the west; (26) The Queen's Jubilee statue; (27) Sir Arthur Kennedy's statue; (28) The Peak tramway; (29) Mount Gough (1200 feet); (30) Mount Austin Hotel (1400 feet); (31) Mount Kellet (1500 feet); (32) Victoria peak and signal station (1825 feet); (33) Magazine gap (1000 feet); (34) Pokfolum reservoir; (35) Tytam reservoir; (36) The harbour and Kaulun peninsula from the peak; (37) The man-of-war anchorage; (38) Kaulun, looking east; (39) Kaulun, looking west; (40) The Hong-Kong and Whampoa Dock Co.'s premises; (41) The Kaulun Wharf and Godown Co.'s premises; (42) The East Point sugar-refinery; (43) The Quarry Bay sugar-refinery; (44) The Wong-Nei-Cheong valley and race course; (45) The grand stand; (46) The Mun-Mo temple (decorated); (47) The reception hall, Tung Wah hospital (48); Native Jubilee decorations; (49) Native flower show pavilion; (50, 51) Queen's road, Central; (52) Procession to the thanksgiving service; (53) Laying the foundation-stone of the new hospital; (54) The review, grand stand, Happy valley; (55) The review, native ladies' pavilion, Happy valley; (56) The Royal Engineers, Wellington Barracks; (57) The Hong-Kong volunteers' headquarters; (58) Review of the troops, Happy valley; (59) His Excellency Sir William Robinson, G.C.M.G., and members of the Legislative Council; (60) Gap Rock lighthouse.

Morocco. **Fawcett.**

Forty Photographs of Morocco. By Captain P. H. Fawcett, R.G.A. 1901. *Presented by Captain P. H. Fawcett, R.G.A.*

Captain Fawcett's journey during which these photographs were taken was described in the *Geographical Journal* for February last. Although small in size, most of the subjects are very interesting. They are as follows:

(1, 2) Water-gate, Mogador; (3) Outside the gate, Mogador; (4) Gate, Mogador; (5) Street, Mogador; (6) Grain market, Mogador; (7) Prison, Mogador: prisoners scrambling for ¼ pesetas; (8) Start of the journey from Mogador; (9) Zalat Harata; (10) Ulad Ben Gasmein, looking about north-west; (11) Ruins of Kasba Lasseuah at Ulad Ben Gasmein; (12, 13) Spring, Tiruman; (14, 15) Jews at Mella Sheshawa; (16) Camp at Mella Sheshawa; (17) Jewish girls at Sheshawa; (18) Crossing Wadi N'Fiss at Sheshawa; (19) Aitmur; (20) Street, Tamesloht; (21) Olive gardens at Tamesloht; (22) On the plain of Morocco between Tamesloht and Morocco city; (23) Plain of Morocco looking south to the Atlas range, from just outside the town walls; (24) Morocco city from the south-west; (25) Market at Morocco city; (26, 27) Street, Morocco city; (28) Kutubieh tower, Morocco city; (29) Camp of Sultan's body-guard at Morocco city; (30) Looking over plain of Morocco towards Morocco city from Jebelet hills; (31) On the summit of Jebelet, looking over plain of Morocco towards Morocco city; (32) Part of Morocco city with Atlas mountains in background; (33) Nzala Menebha, looking south towards the Jebelet hills; (34) Looking out of tent, Nzala Menebha over Rahamna plain to north; (35) [illegible], looking east; (36) Entrance to subterranean dwellings, [illegible]; (37) Well over 300 feet deep, at Ulad Waris; (38) Mazaghan from the south-east; (39) Casa Blanca from the land side; (40) Street, Casa Blanca.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

The

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THE ANCIENT KINGDOM OF KONGO *: ITS PRESENT POSITION AND POSSIBILITIES. †

By the Rev. THOMAS LEWIS.

It is a matter of genuine regret that a subject so full of interest and importance is not in the hands of a man who can do it justice, and bring with him more experience and authority in matters geographical than I possess. It has been my privilege to labour in Africa under the auspices of the Baptist Missionary Society for nineteen years, fifteen of which have been spent in Portuguese Congo, and for the most part at San Salvador.

My journeys in Kongo and Zomboland have been made wholly with a view of facilitating and extending the work of our society, and of studying the customs and habits of the people. But whatever qualifications I lack as a geographer, I claim to be a sincere devotee of the science, and an enthusiast in the work of opening up the Dark Continent to the light and blessing of civilization.

It is a remarkable fact that the northern portion of the province of Angola is the least known of all the districts in this part of Africa, notwithstanding its proximity to the sea-coast, and its being the first discovered by the early Portuguese travellers, and the country covered by the ancient kingdom of Kongo. We owe the very name of "Congo" to this old kingdom, for according to native usage the name applies only to the district around San Salvador, the native name for which is "Ekongo," and the natives know no other. The Congo river is generally called Nzadi, or Nzari, which means "the river," and is corrupted

* The form "Kongo" is adopted in this paper when it applies to the Ancient Kingdom, from which the name is derived, and "Congo" in its modern use as referring to the river or State territory.

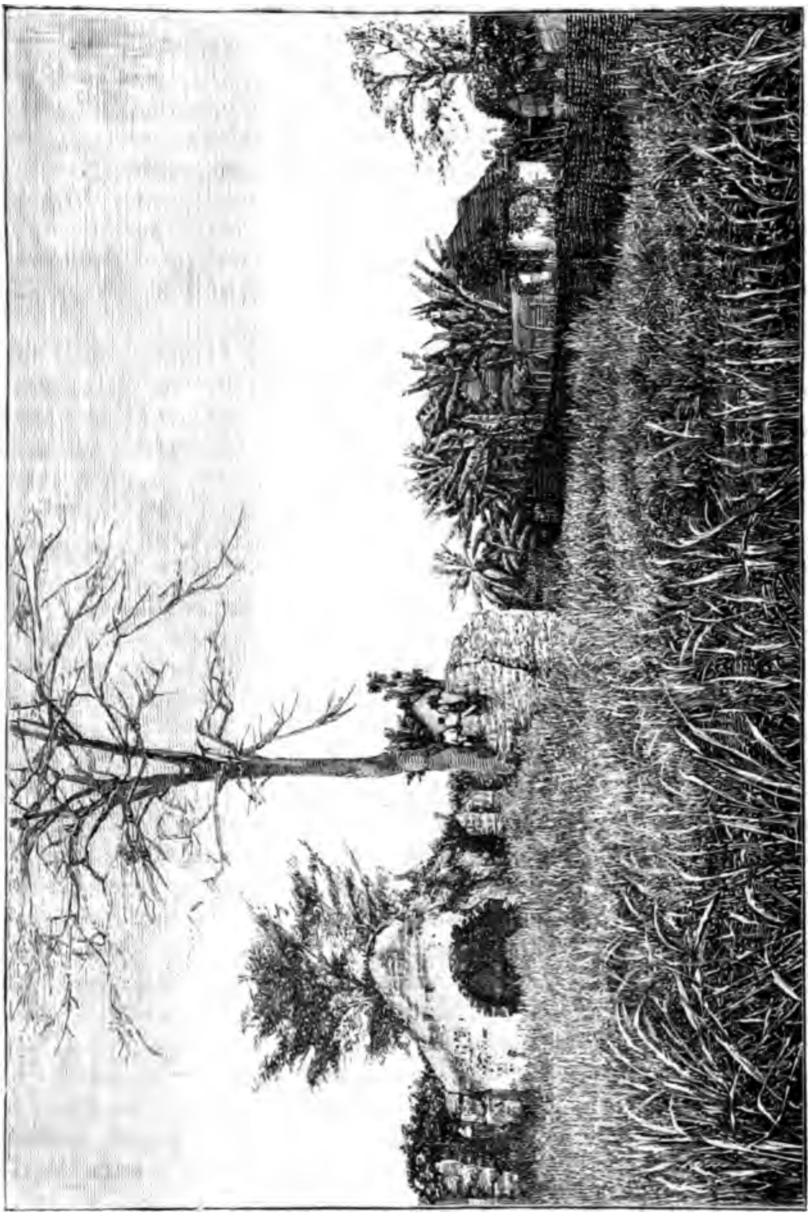
† Map, p. 668.

by the Portuguese into Zaire, but when the people wish to distinguish it from other rivers, it is called Mwanza. Owing, perhaps, to the prominence given to the Kongo kings and court in the records of the Portuguese navigators and explorers of those days, the name has been applied in modern times not only to the ancient Kongo country, but to the Mwanza river, and to the vast region on both its banks reaching right away to the furthest limits of the Congo State. But while those vast regions are being rapidly opened up to the influx of commerce and civilization, this land, so rich in history and interest, has been passed by and to a great extent forgotten. What is known to-day of the ancient provinces of the kingdom of Kongo—Sonyo, Mbembe, Mbamba, Nsundi, Mpangu, and Mbata? Even Sonyo, situated nearest to the coast towards the mouth of the river, is practically a *terra incognita* to-day. Very little is known of this northern district lying between the river Congo and the Kwangu; even the delimitation of the boundary between the State and Portuguese territory has not yet been carried out.

We first became acquainted with this marvellous country in the story of the voyages of Diogo Cam, who, on reaching the mouth of the river in the year 1482, learnt from the natives who boarded his vessel that "far in the interior there lived a powerful king." He thereupon despatched to this king "some Christian negroes as his ambassadors," to assure him of the friendly intentions of his visitors from Portugal, and of their desire to trade. Thus was effected the first discovery of a wonderful people and a powerful African monarch.

Battell, Duarte Lopez, Cavazzi, and others have left us truly wonderful descriptions of the kingdoms of Kongo and Angola as they were, or supposed to be, in the fifteenth and sixteenth centuries. And, making due allowance for a vivid imagination in matters of detail, we are compelled to recognize the royal service which these early travellers rendered to the cause of what may be termed "unscientific geography." In those palmy days of the Spanish and Portuguese nations, there is no doubt but that a certain amount of civilization was introduced into the country. The whites who were sent out from Portugal established themselves at several points on the south bank of the river, and with commendable skill and perseverance built houses, fortresses, and churches, the ruins of which are still to be seen at Sonyo near the mouth, at Mbembe in the interior behind Ambrizette, and notably at San Salvador, the capital of the ancient kingdom. This last is beyond doubt the most important, and is full of historical interest. We read of a mighty monarch who ruled over a vast region, with a host of princes governing dependent provinces. The pomp and glory of this brilliant court are startling in the extreme, and one gasps for breath at reading of the rapidity with which the king and nobles of a hitherto heathen and pagan country put on the garb of our European civilization and espoused the Christian religion. For in the year 1491 many priests arrived from

Europe, and very soon three churches were built—one dedicated to the Saviour, whence the city derived the name of San Salvador; the second



RUINS OF ANCIENT CHURCH, SAN SALVADOR.

and third were dedicated to the Virgin Mary and St. James, in recognition of their miraculous intervention on behalf of the people at a critical

point in one of their battles. These were not, however, the first, for a church was erected when the first Christian king, Don Joaõ, made a vow of fidelity to God, and planted a large wooden cross in an open space in the town as a witness; afterwards he commanded that a church be erected on the spot, to be called the Church of the Holy Cross. In all eleven churches are spoken of as having been built here, but it is almost certain that they did not co-exist. Old buildings were destroyed and rebuilt; these were rededicated to some other saint according to the tastes of the priests there at the time, and hence the confusion. We are assured, for example, that one night the devil came and carried away the roof of the church of Santa Cruz, and the Yakkas from the Kwangu, who seem to have been in league with his majesty of the lower regions, followed hard after, and completed the destruction of both church and city.

When the Kongos, after a short period, reoccupied their capital with the help of Portuguese traders and priests, they directed their attention to the fortification of the city, and surrounded it with massive stone walls. They also constructed inner walls around the king's palace and the dwellings of the nobles; also one surrounding the European quarters. Pigafetta speaks of these walls, and his description of them is one of the few things that can be relied on in his highly embellished book of romances.

There may arise at some future time some sceptical and unbelieving spirits, who, unable to discover any traces of these walls, will ridicule the idea that they ever existed. The Government authorities and the Roman Catholic Mission at San Salvador have no veneration for these relics of a glorious past. The city walls have been demolished, and the stones from the foundations have been requisitioned for modern Government buildings. Our own mission has assisted in these acts of vandalism; but we protected the last piece of stone wall near the cathedral ruins —probably a portion of the monastery where the priests dwelt—until it became dangerous to life. Three years ago we were reluctantly compelled to pull it down, and the stones were used to erect a modern church large enough to accommodate 900 worshippers. About the same time the priests and Government officials made a futile attempt to restore the old cathedral. They pulled down the walls of the main building, and the side chapel dedicated to "Our Lady," with the intention of erecting a practically new church, but preserving the main arch of the chancel and the eastern end which contained the old and massive stone altar. They carried the walls up nearly to the square, when suddenly the whole structure collapsed. It was not the devil this time, but a heavy storm during the night, which caused the fall. The new building was not laid on the original foundations, and a rotten foundation on the graves of generations of African royalty was not sufficiently strong to bear the weight of a modern church. This

accounts for the present condition of these once picturesque ruins, and it must be confessed that they have lost the greater part of their interest to us. The arch, however, is still left us, standing firmly among the *débris*, and is about the only thing left to mark the civilization of three centuries ago.

The massive walls and churches were built of the ironstone so plentiful on the plateau on which San Salvador is situated. Some huge blocks of this stone were used in the foundations and for the doorways and arches of the churches. The walls had thin layers of limestones used as "headers" to bind them together. Very excellent mortar was

LAST PIECE OF THE CONVENT WALL, SAN SALVADOR.

made, and an abundant supply of limestone was obtained from the quarries a few miles away. The amount of labour represented by these ruins must have been enormous, but we must remember that the work was done in "the golden days of slavery," and Kongo at that time was the great centre of the trade. The population of the capital then is given at 100,000; to-day it does not exceed 1500.

Time changes everything, and to those of us who have laboured so much in trying to find good building-stone wherewith to build our houses, it is most tantalizing to read the fine description of the rocks of San Salvador given by Pigafetta. He says—

"The mountains of Congo furnish quarries of various valuable stones, from which might be cut columns, architraves, bases, and other

large blocks, for building anything that was required. Indeed, it is said some masses are of such enormous size, that a whole church might be cut out of a single piece of the stone, like that which forms the obelisk now standing before la Porta del Popolo. Besides these, there are the mountains producing porphyry, jasper, and white and coloured marbles, which in Rome are known as Numidian, African, and Ethiopian marbles, some columns of which are in the Gregorian Chapel. Other marbles are found here, and amongst them very fine ones inlaid with jacinths, which are gems, and form veins on the mother stones, and these, when separated and arranged in small pieces, can be formed so as to look like pomegranates. Columns, obelisks, and such-like works of art can be made from this marble, which sparkles as if studded with beautiful jewels."

Alas for the deterioration of the ages! As if it were not enough to rob us of the pomp and pageantry of a mighty African kingdom with its magnificent civilization and religion, we are left to wonder what has become of these mountains so marvellously rich in beautiful and precious stones. Pity they did not use this Numidian or Ethiopian marble in the construction of their churches—or at least in that of the church altars—instead of using the common ironstone. The fact is, these mountains of porphyry, jasper, and marble are purely the product of unbridled imagination.

It is impossible, with materials at our command, to say how long this city was occupied by the Portuguese. When the "trade" was firmly established, and the kings and nobles of Kongo became the active agents of the white traders and faithful vassals of the King of Portugal, the European residents could withdraw to the coast at Loanda and Ambrizette, paying yearly visits during the dry seasons to San Salvador to conduct to the coast the accumulated gangs of slaves. Sometimes, however, the gangs were entrusted to the care of a reliable native. I knew well two old men who went repeatedly for this purpose to Loanda. They counted on three months for the return journey, and many gruesome tales they had to relate. They thought that they were in the service of Nemputu, the King of Portugal! The companies of slaves were generally accompanied by one or more priests, who received slaves from the natives in return for baptizing their children and administering spiritual consolation to the nobles of the land. These gangs of chained slaves, moving ponderously along on their way to the coast, have left behind them indelible marks; and their tracks are easily recognized by the names of towns and villages where they halted or encamped for the night. Such names are "Vunda," meaning "rest," where the midday halt was made, and "Vemadia," a corruption of "Ave Maria," where the priests and their newly made converts in bond chanted their vespers and rested for the night. Kinganga, again, is a name of a "town of the priests," and

the inhabitants of these towns consider themselves to this day the property of the Nganga, or the Catholic priest.

We have all through Kongo and Zombo a distinct connection with the past in the Santu or Christian names which every man and woman indiscriminately adopts in addition to the usual native name. The early priests gave their converts Christian names, and the titles Don and Donna were prefixed to the names of the king, queen, and princes. This established a custom which delighted the heart of every savage, and now every child that is born in the land is dubbed Don or Donna something; and it would be a most interesting psychological problem to demonstrate the power by which such empty and self-assumed titles

"IVORY" ROCKS NEAR SAN SALVADOR.

and names can fill a savage race to such a degree of unspeakable pride and personal vanity. It is considered a serious breach of etiquette and a personal insult to address anybody without first mentioning his Santu name, and elaborately calling him Don so-and-so.

The crucifix is another relic of the early missionaries, and is to be found often among the many fetishes of native chiefs. These are generally made of a brass figure fixed to an ebony cross, and in the Kongo district they are looked upon as charms. The Christian symbol or meaning is entirely lost, and they are besmeared with the sacrificial blood of animals at the hands of the witch-doctors in the same manner as all their other charms. In Zombo, however, the crucifix is a symbol of power passed down from one chief to his successor. This custom is general. Sometimes it is a sceptre, as in the case of the kings of Kongo, sometimes a sword, a knife or any trinket. The only crucifix

I have seen in Zombo belongs to a chief who rejoices in the name of Nkila-nkosi (the Lion's tail), whom I found one day sitting outside his hut polishing it with a piece of cloth and ashes. I was at once deeply interested, and he conversed freely with me about it, but it had no supernatural significance to him, and it was only a symbol of his chieftainship. He waxed eloquent at my asking him what would happen if it was lost or stolen from him, and he assured me that he would wage war with any offending clan who attempted such a thing. And he meant it.

No doubt the crucifix is the origin of the multitudinous crosses that are met with at every point. Nearly everybody has one among his fetishes, and sometimes they are elaborately carved. The traveller also sees arranged on the walls of houses of chiefs little crosses made of folded palm leaves. These represent presents of palm-wine made by visitors, and in accordance with strict etiquette, a leafy cross is inserted at the side of the stopper of each calabash or demijohn as a sign of respect to the recipient. He in turn displays these loving tokens on the walls of his hut to let passers-by know what an important man he is. And there is often a keen competition among rival chiefs as to who can display the greatest number. So it has come to pass that the most holy of symbols can be degraded to one of petty jealousies and debauchery.

Speaking of crosses, it is interesting to note that at the Kibokolo market-place, in the Zombo country, there is a huge wooden cross erected, as I have been told, to commemorate a treaty of peace made between the different clans of the district when they agreed to make this their common market, and their cause a common cause. Hence, the mere existence of wooden crosses does not necessarily mean that they mark the site of ancient Catholic missions.

To bring our story down to modern times, it is necessary to say that the kingdom many times in its history had to pass through trying and turbulent seasons, and there were occasions when the succession to the throne was not an easy matter to settle. The practice of polygamy does not simplify questions of royal succession, and there are always those conflicting claims of various clans and families who are ever ready to fight for the imaginary glory of such an exalted position as is only offered by a royal throne in the wilds of Africa.

One of these occasions occurred about fifty years ago, when three important clans gathered their forces in the neighbourhood of San Salvador, each claiming the right of succession. There was considerable fighting, and trade was impossible. The Portuguese despatched a force into the interior to quell the disturbance. They espoused the cause of the Kivuzi family, but not until there was much bloodshed did they succeed in placing Don Pedro on the coveted throne. Mbumba, one of the rival claimants, was appointed to the nominal position of

prince, and the title of "Nosso Principe" was conferred upon him. The third refused to acknowledge the new rule, and until his death, three years ago, he declined to pay homage to the King of Kongo. He hated the Portuguese with a perfect hatred. During the war a Portuguese officer fell into his hands, and Kiamvu carried away the head in triumph to his town, only a few miles away across the river Luezi. He cut out his heart, which he triumphantly ate at a great feast in honour of the occasion, while he drank his palm-wine out of the cranium of his victim's skull. This spectral vessel was constantly brought out on special occasions for his drinking-cup when he wished to display his prowess in war and his hatred of the Portuguese. Since

LUSENGELE STREAM, KIBOKOLO.

his death this relic has come to the hand of Senhor Faria Leal, the present Resident at San Salvador.

During this short occupation the Portuguese built a fortress covering a little under an acre of ground on a projecting point on the eastern end of the plateau. This stands to-day, but is of no special interest to us.

Such is the past record of a kingdom which has now been reduced to all but an empty name, for the present king of Kongo is nothing more than an ordinary native chief, with very limited powers, even over his own people. Nevertheless, he is endowed with a remarkable amount of self-importance and conceit, imagining himself of more consequence than the Tsar of all the Russias, and having an equal only in the King of Portugal.

The district of Kongo, as this northern portion of the province of Angola is officially known, varies considerably in different parts in respect of soil, climate, and scenery. A distant view from the deck of an ocean steamer as we enter the mouth of the river affords a most pleasing effect of a combination of graceful palms and tropical verdure, and the eye catches with delight a glimpse of the green grass which clothes the distant hills; but as we steam up the river close to the banks of the swampy islands, and watch the muddy water oozing out from among the peculiarly formed roots of the mangroves, one's enthusiasm for the beautiful is very considerably modified. When about 60 miles from the mouth, we reach Boma—the capital of the Congo State—on the north bank, where there is quite a settlement of Europeans of all nations, but principally Belgian officers of the State. The mangrove swamps are now left behind, and the river becomes narrower, with rugged barren hills on both sides. We have lost the thick tropical foliage, but it is decidedly picturesque (from the deck of a steamer). When Noki or Matadi is reached, and we make the acquaintance of real African life, it is then that we realize what the Kongo country and the climate can be. Many a new-comer has watched the departure of the steamer in which he sailed for this inhospitable land, with a bitter tear and an aching heart, and often saw it for the last time. Noki and Matadi, in close proximity to each other, are perhaps the most deadly places on the Congo. The heat is great, and the bare rocky surface of the soil around the dwellings reflects the rays of the sun so that sometimes it is unbearable. The sanitation, or rather the absence of it, is a disgrace to any nation, and happy is the man whose lot it is to proceed inland and dwell on the highlands of the interior. We who go into Portuguese territory climb up the famous Noki hill, the ruggedness of which did not seem half so formidable from the steamer as it is in reality; but once on the top, about 900 feet above the sea, we breathe more freely. We proceed on our journey, at first dodging around boulders of rocks and passing over rough road, but as we advance further away from the river the soil becomes richer and the roads better. For the first three days we meet with hardly any native villages, and there is very little cultivation of the ground; but after the third day we come to the rich valleys of the Mpozo and Luzo; then we cross the Lunda and lesser streams, all running into the Mpozo. In the productive soil of these valleys the grass grows very high—about 15 feet in some places—and it is with great difficulty we make our way through it. Nearing San Salvador, which is reached about the sixth day, the country becomes more hilly, and about three and a half hours before we reach the capital we pass the Mpungi, or Ivory rocks, so called by the natives on account of their peculiar peaky appearance. There are many superstitions about those rocks, which cannot be noticed in this paper.

At San Salvador we are 1840 feet above sea-level. The town is very much like any other African village, situated on the top of a hill, with the river Luezi winding at the foot from the east to the south. Here we have come within the limits of the accompanying route-map, and I need not enter into much detail about the country. Leaving San Salvador in an easterly direction, we pass over an undulating country, and after travelling about 50 miles we reach the foot of the plateau. The ascent is very steep and rugged, and the scenery grand. Close by are the Mbrizi falls, well known to geographers; but there are, not many miles to the south, two other falls, to all appearance equal in volume to those at Kizulu, and the waters of both falling into the Mbrizi in the valley. Travelling along this plateau, we pass the source of the Mbrizi river, and not far away is the highest point I have registered, viz. 3400 feet above the sea. Further on this plateau is abruptly broken by the Lufunde valley, on both sides of which are deep chasms and precipitous rocks, and the sparkling waterfalls are a delightful change to the weary traveller after the monotony of the journey. The valley is very fertile and well cultivated, but there are many swamps and morasses, which are here utilized for an extensive eel fishery. They are caught by means of small bottle-shaped basket traps made of split bamboo. The fish are arranged on a spit about a yard long, and then smoked over a fire, and thus preserved they are ready for the markets. The catfish (*ngola*), which abounds in the rivers, is treated in the same manner.

Having crossed the Lufunde, we ascend once more to the plateau where, three years ago (in 1899), our society established a new mission station at Kibokolo, which I hope to call my home for some years to come, and make it a centre from which to make journeys into the unexplored regions to south and east. Continuing our journey eastwards on the plateau, we come to the Nkissi river, which is known here as Nzadi a Malewa. The Malewa valley is extremely swampy, and the river constantly overflows its banks during the rainy season, rendering it dangerous to cross in the roughly hewn native canoes which ply for hire at the various ferries. The river is infested with crocodiles, but there is some fishing and a large quantity of edible shellfish, in appearance like periwinkles, but much larger. This is the furthest point east that we have touched, and I found that the dialect spoken in this district differed somewhat from the Kongo language, although we could easily understand each other.

The principal point of interest to the geographer in this sketch-map of the Zombo highlands is the number of river sources it shows. Zombo, in a most literal sense, is a land of water and streams, clear as crystal; sometimes rippling through shady glens and pebbly watercourses, then dashing down a ravine and over the precipitous rocks into the valley beneath. Within this small area we have the sources of the well-known

rivers of Luvu, Kwilu, Fulezi, Luango, all running north towards the Congo; while the Mbrizi, Pasasa, and Lufunde flow to the south, joining, however, before they empty themselves into the Atlantic. Thus the Zombo country forms the watershed of the Congo-Mbrizi basin.

The greatest part of the country is covered by the common African grass, which, however, is shorter and less coarse on the highlands, and is burnt by the natives in the dry season of every year. The woodland is practically confined to river-banks and ravines, with patches around the towns and villages. Good timber for building purposes is limited. There are one or two excellent trees, notably the nkamba, or African mahogany, and nlongwa, a good working wood, of which there is a fair supply in most districts. The baobab is met with everywhere, but is practically useless.

The soil is good and produces a variety of things. In Kongo the women do all the farm work, but in Zombo the men are more industrious, and do a fair share of the farm labour. The tillage is of the simplest and the implements primitive. The hoe is the only implement used, with a cutlass to clear away the brushwood if necessary. They work a piece of land for a year or two, and get out of it an average of three crops a year; then they allow it to lie fallow until they take a fancy to return to it. There are no land laws, and consequently no landlordism—a model place for a certain class of politicians—and the first person to select a plot of ground and mark it with his hoe, occupies it as long as he uses it. No rent or taxes are demanded. The African grows his food cheaply and easily, for the labour of scratching the surface of the soil with a hoe is very light. The principal native products are the manioc or cassava, yams, sweet potato, maize, millet, and various kinds of beans and pumpkins; the seeds of the latter are considered a delicacy, and take the place of meat to a great degree. These, with the plantain and banana, are the principal foodstuffs of the Kongos and Zombos.

The natives are not heavy meat-eaters. The domestic fowl—that marvellous combination of skin, bones, and feathers—the old friend of all African travellers, and the inevitable bleating goat, are common to all districts. There are also some sheep to be had. But the darling pet of a Kongo man is his pig. You can treat his wife and children as you like, but if you touch his pig, beware! To kill a man's pig that breaks through your fence and digs up your vegetable garden is to commit the unpardonable sin, and the owner never forgives you. Hog's flesh is equally dear to him. Game in some parts is plentiful, but more especially in Zombo. There we have several kinds of deer, antelopes, and wild hares; the only difficulty is to bag them. Guinea-fowls, partridges, and pigeons abound, and there are some pheasants; and in the swampy valleys we find wild ducks and many other birds. Eagles, vultures, and other birds of prey, are common, and very

annoying, while the woods are resplendent with the gorgeous plumage of the birds. Elephants, buffaloes, and leopards are to be found, but must be sought for in the more sparsely populated districts.

The climate of Zombo, compared with that of the Congo in general, is healthy. At Kibokolo, although for the past two or three years we have lived in a rough way in temporary grass houses, the health has been excellent. The same thing may be said of the Portuguese at Makela, who say that the climate is equal to that of Portugal, which is doubtful. It is too early yet to speak with any certainty on this subject, and time alone can decide it. But with an altitude of over 3000 feet, a sandy and well-drained soil, with an abundant supply of

A NATIVE SMITHY, CONGO.

excellent water, I see no reason why it should not be a fairly healthy climate. Certainly it is a great improvement on the swampy lowlands of the Congo valley. The mean maximum temperature is 84·6° in the shade, and the mean minimum 64·8°, thus giving an average daily range of twenty degrees. The rainfall last year was 55·5 inches, which, I believe, was below the average. The rainy season is from October to May. Reports recently received from Kibokolo announce very heavy rains in the month of September last.

We must here pass by the manners and customs of the people—the subject is too tempting a one to venture even on the fringe of it—but we must say a word in reference to the natural capacity and character of the people themselves.

The native is the principal factor in the development of any country, but especially is this the case in the tropics, where everything depends

on native labour. We cannot afford to neglect him; and no knowledge of the country is complete without a thorough understanding of the native as he is and as he can be. The mind of the savage is not a blank; and when one becomes familiar with his beliefs and superstitions, and the complicated nature of his laws and customs, preconceived notions of his simplicity of thought go to the winds. I have yet to find that most apocryphal of beings described as the "unsophisticated African." We laugh at and ridicule his fetishes and superstitions, but we fail to follow the succession of ideas and effort of mind which have created these things. After most careful observations extending over nineteen years, I have come to the conclusion that there is nothing in the customs and fetishes of the African which does not represent a definite course of reasoning. On my first journey into the Zombo country, in 1898, we came across at almost every point a peculiar arrangement in the form of a trap, which was set up at the entrance into villages and huts, and on inquiry I learnt that these were traps with which they endeavoured to catch the devil. Very ludicrous, certainly; but then I tried to imagine the gigantic feat of mental exercises which enabled them to think out a plan to secure so desirable an end. And can it be possible that the savage mind has gone a long way ahead of his civilized brother in making some attempt to capture the common enemy? The point which I wish to press is that the native is capable of thinking and reasoning, and therefore can be trained to take a prominent part in the development of his country.

Hitherto, both the country and its people have been sadly neglected. And I venture, at this critical time in the history of Africa, to put in a plea for a fuller recognition of the native element in dealing with African questions. You cannot manage Africa apart from the African, and the future destiny of this vast continent from the Cape to Cairo will depend in a large measure on how we deal with the natives. It is of the utmost importance that they should be trained and equipped to take their proper position in the triumphant march of progress and civilization. I view with the deepest concern and distrust the present fever-heat rush of civilization into the heart of Africa. It is not a natural growth, and it does not represent any real development of the native character. It is the quick growing fungus that rots the whole structure. It is the donning of a suit of ready-made clothes to cover the Ethiopian skin, and the wearer will not know how to mend or patch it. The imported article is very good for fiscal purposes, but, whether it be in commerce or in religion, we ought never to lose sight of the truth that a veneer of civilization is the worst possible thing for a savage people, and carries with it the seeds of all trouble, political and otherwise. Freedom without principle means anarchy and confusion. For this reason domestic slavery cannot be abolished by force. The progress of the country and the advancement of free institutions

depend wholly on the development of the character of its people, and this can only be effected by a long and patient course of training. And in this noble work Christian missions occupy a leading position.

From this point of view, it is not altogether a disadvantage that this country is in the hands of the least ambitious and self-assertive of European governments. The very weakness and poverty of the Portuguese has its advantages, for the small military force at their command makes them wary of entering upon mischievous punitive expeditions and thus devastating large tracts of country. About twenty native soldiers are sufficient for San Salvador, and at the military post of Makela the officer there has managed to keep the peace with three. I have great admiration for the tact and wisdom of any government which guards itself against the mistake of placing too many soldiers at the command of an inferior and inexperienced officer. Nevertheless, one would fain see a little more activity on the part of the Government in opening up the country, and it is a matter for congratulation that during the past few years some advance has been made. In the year 1887 an official resident settled at San Salvador, but commercially this old capital is of little importance, and the trade is very small. The trade routes and rubber markets are some distance away. While the Portuguese were vegetating on the coast and at San Salvador, the trade was being diverted across the borders into the Free State at Chiloango, Tumba Mani, and other points where the Belgians had prosperous trading stations. This constant deflection of trade from the Portuguese district had the effect of waking up the authorities to a sense of their duty, and in 1896 a fiscal station was established at Makela, near the borders. Seven or eight trading firms have their agents there at present. The competition between them is very keen, and it is doubtful whether the existence of so many conflicting interests are a blessing to the country in any sense. Three years later a third military post was established to guard the interest of the province at the extreme north-east corner on the Kwangu river, and it is expected that this will be effective in protecting trade.

A more important move, in my opinion, would be to protect the principal caravan routes from the interior to the coast stations. Often these routes are closed against all on account of native disputes and fightings. On such occasions unwary caravans are attacked and plundered of all their goods and produce. Even in time of peace, it is appalling the amount of blackmailing that goes on. The owner of a native caravan with rubber, going from Zombo to the coast, considers himself fortunate if he reaches the trading stations with half his rubber in his possession, and more fortunate still if he carries home with him the greater part of the goods he received for it. This blackmailing system is of such enormous dimensions that whole towns and districts practically live on their plunder of native caravans, and, as far as I

know, the Government has never attempted to cope with this most serious obstacle to trade and the development of the country. I am far from suggesting the misguided policy of despatching a force of native soldiers to burn towns and villages and clear the *routes* of all natives. This is no government, and whenever the policy has been followed it has been most disastrous. It is of the first importance that native carriers should be able to obtain food on the way as they go with their heavy burdens to the coast, for they cannot carry with them sufficient provision for their return journey. This fact partly accounts for the great difficulty experienced by traders and others in obtaining carriers for the transport of their merchandise. This transport problem is a very serious one, and the final solution of the difficulty will not be arrived at until railways have been constructed from the coast to the chief markets in the interior. Under the present system the Government official at Makela is practically a recruiting agent, running all over the country and demanding under threats and penalties so many carriers from native chiefs for the various trading houses.

But the most serious outlook for the future, however, is that the whole district, rich in fertile valleys and productive highlands, is lying idle, without any attempt to make use of it. The last report of H.M. Consul at Loanda is absolutely correct, when it says that "thousands of square miles of rich land are to be met with on the margins of the different rivers and in the higher lands in the interior awaiting the plough and harrow," but the Government gives no facilities or encouragement to bring these vast regions under cultivation. A school of agriculture and the establishment of a botanical garden would be a step in the direction of averting the total ruin which threatens the province. I do not know of a single commodity of commercial value which is produced in the Kongo and Zombo countries except what the natives consume themselves. A little coffee is grown in one or two places. The cultivation of rubber has almost, if not wholly, disappeared. What is brought to the markets to-day comes from a long distance away. The soil will grow almost everything. Coffee grows well; the tobacco-plant is a sight worth seeing in Zombo, and flourishes everywhere; sugar-cane thrives luxuriantly in the valleys and on the hills. In fact, with a little enterprise, I see no reason why other tropical and sub-tropical plants should not be introduced, with lasting advantage to the country.

Here we are confronted with the difficult problem of native labour, which is essential to success in an agricultural undertaking. But I venture to think that this is not so serious an obstacle as we are sometimes led to believe. The African native *can* work and *will* work when he is taught to take an interest in it, as can be shown by the fact that the large church completed three years ago by our mission at San Salvador was built *entirely* by the young men trained by myself, and

paid for by the natives themselves. The difficulty in the case of a savage is that his needs are so few that there are really no inducements for him to work; and as long as he is satisfied with bare animal existence, simply to eat and to drink and wear no clothing, there is no earthly reason why he should do any work. The obvious remedy to all this is to create new needs by educating him to take a wider view of life and holding before him higher ideals. It is an immense advantage even to trade to tell a man that he ought to support his wife and children in a respectable manner, to build a decent house to shelter them, and to clothe them modestly as human beings, instead of depending on his wives for the food which he eats. He will then have to rouse himself from his sloth and inactivity, and apply himself diligently to some remunerative occupation, which will be the making of himself and the salvation of his country.

In closing, I would say that the future of this ancient kingdom of Kongo does not depend on the discovery of gold or copper mines within its borders, but on the more important discovery of the native himself—the discovery of all that is best in him and all that is noble. For generations he has been looked upon as "a slave," "a piece," and "a hand," but not until the *man* in him is found and recognized can there be any real progress made in the development of Africa.

APPENDIX.

METEOROLOGY.—The following is an abstract of thirteen months' meteorological observations made by the Rev. Thomas Lewis at Comber station, Kibokolo, in the Zombo country (6° 16′ S., 15° 17′ E., 3100 feet). The instruments in use were a self-registering rain-gauge by Crosley, and a combined maximum and minimum thermometer by Hughes & Sons.

Month.	Temperature.					Rainfall.		
	Mean max.	Mean min.	Mean 9 a.m.	Extremes. Highest.	Extremes. Lowest.	Inches.	No. of days.	Highest in 24 hours.
1899.	°	°	°	°	°			
November	83·5	65·8	71·9	91	63	9·26	16	3·12
December	84·2	65·9	73·4	93	61	7·25	11	1·01
1900.								
January	83·5	66·7	70·8	92	65	7·16	9	1·62
February	86·2	67·4	71·1	93	66	6·98	5	2·44
March	86·5	66·7	73·2	98	63	5·06	9	2·70
April	86·0	66·8	72·5	93	63	12·22	13	3·35
May	88·3	66·6	73·0	98	63	5·66	9	1·35
June	84·4	61·0	66·5	97	55	0·00	—	—
July	79·9	57·6	62·0	92	54	0·00	—	—
August	81·2	57·9	63·3	89	53	0·00	—	—
September	83·7	62·1	67·6	93	56	0·81	3	0·45
October	85·6	65·5	71·4	95	62	8·19	9	2·07
November	84·9	65·8	72·7	91	63	5·00	12	1·28
Means or totals * ...	84·6	64·8	69·8	—	—	58·33	80	—

* December, 1899, to November, 1900.

The first rain in 1900 fell on September 15. June to August were rainless. There are two rainy seasons, as at San Salvador, with maxima in April and in October or November. Heavy hail fell in the afternoon of December 29. Many of the hailstones were over half an inch in diameter, and the ground was white.

MR. LEWIS'S MAP.—The map accompanying this paper is based upon the Rev. Thomas Lewis's itinerary surveys, checked by latitude observations at eleven stations. The longitudes are dependent upon the Rev. Geo. Grenfell's careful determination of the position of San Salvador, viz. 6° 15′ 45″ S., 14° 17′ 30″ E. These results differ very considerably from the results claimed to have been obtained by Dr. Chavanne, viz. San Salvador, 6° 20′ 28″ S., 14° 47′ 3″ E.; and Kizulu village, 6° 17′ 19″ S., 15° 18′ 54″ E. ('Reisen und Forschungen im alten und neuen Kongostaate,' Jena, 1887, p. 455). Information furnished by former explorers of the country has been inserted in skeleton letters.—E.G.R.

Before the reading of the paper, the CHAIRMAN (Mr. G. S. MACKENZIE, Vice-President) said: I regret to say that through indisposition your President is unable to be present to-night to fill the chair, and I am called upon to do so in his absence. I have much pleasure in introducing to you the Rev. Mr. Thomas Lewis, who has spent twenty years of his life on the West Coast of Africa, and will to-night read to you a paper on "The Ancient Kingdom of Kongo: its Present Position and Possibilities." We are indebted to the African missionary, not only for his work in educating and civilizing the native, but also for the many important geographical explorations made by him. In connection with the latter, I have only to mention the names of Livingstone, Moffat, Hannington, Mackay, and many others too numerous to enumerate, to ensure our giving Mr. Lewis, as a member of the missionary body, a most hearty welcome here to-night. I will now ask Mr. Lewis to read his paper.

After the reading of the paper, the following discussion took place :—

The CHAIRMAN: We have a letter of regret from Sir Henry Stanley, saying that he is unable to be here to-night. He made an effort to get off a previous engagement, but was unable to do so. Sir Harry Johnston wrote also to say he had an engagement, but, if possible, would look in.

Mr. E. G. RAVENSTEIN: I am a very poor substitute for either Sir Henry Stanley or Sir Harry Johnston, but I will, nevertheless, offer a few remarks. I think you will all agree with me that we are very much indebted to the Rev. Mr. Lewis. It is not the first time that the Society has been indebted to a missionary of the Baptist Missionary Society. Mr. Grenfell before this has achieved distinction as an African explorer, and, though a missionary, has done geographical work which, I believe, exceeds in value the work done by many men who claim to have gone into Africa as African explorers. Mr. Lewis has spoken wisely and discreetly of the needs of Africa. It is wonderful to think that the ancient kingdom of Kongo, which was supposed to be a glorious kingdom in the days when the Portuguese first became acquainted with it, should have sunk so low, notwithstanding the influence of civilization. But this is not what I should like to speak about to-night; I rather wish to draw attention to the great value of the geographical work done by Mr. Lewis. He is quite right in deploring that this kingdom of Kongo, with its history of 400 years—a very long history for an African kingdom—should not be better known in these days. The Portuguese knew it in their early days, and so did the missionaries, but their accounts were so vague that we utterly failed to

reduce their views to anything like a correct map. And as to other facts, I am afraid we shall have to take, and we have taken, all they have said about the history of this State, and of their own achievements as missionaries, with a grain of salt. Anyhow, I do hope a better time may come; and certainly so far as geographical exploration and a careful mapping of the country are concerned, that time has come with the advance of our missionaries and explorers. The country to the east of San Salvador in ancient days was frequented by Portuguese slave-traders and missionaries, who were also slave-traders, but even at the present time we know very little about it. It has been crossed recently by two or three German explorers, but their work is of very inferior value. I believe now for the first time we get some accurate geographical information through Mr. Lewis's work. He determined latitudes and made careful route surveys, but probably not as careful as he will do next time, after he has passed through the hands of our very competent instructor, Mr. McCarthy. We are thankful for favours past, but we look forward to favours to come. Very important is the careful determination of the position of San Salvador. It is really remarkable that a town of historical interest for 400 years past should have been placed hitherto 30 or 40 miles out of its true position. Mr. Grenfell, by careful observations, aided by Mr. Lewis, has now placed it in its proper position, and it is now a point from which we can start survey work. I hope these Baptist missionaries will not neglect geographical work. I really do believe that geographical and meteorological work would considerably aid them in their more professional duties as missionaries, and I do hope that some of the £500,000 which Mr. Arthington has left to the Missionary Society will be employed in forwarding geographical work.

Dr. ARTHUR HAYDON: Mr. Lewis just now drew our attention to an albino, and I should like to ask him whether, in the course of his travels, he came across what you might call "white natives." I have seen in South Africa what are known as "White Kaffirs," who are not albinos. They have normal eyes and black woolly hair, and are in most points exactly like the ordinary black Kaffirs; but they differ in having a skin as white as an Anglo-Saxon. There appears to be no mixture with European blood to account for this. If Mr. Lewis could give us any information on that subject, I think it would be particularly interesting. Also I should like to ask whether there is any alteration in the physiognomy. whether the white native or the white Kaffir still retains the native physiognomy, or if it is in any way altered?

The Rev. THOMAS LEWIS: With regard to the question of the albino, in travelling all through the Zombo and the Congo country I have never come across any white natives; we have many brown and different colours, some more black than others, but nothing approaching white natives such as we hear of in South Africa. I have simply seen the albinos only.

The CHAIRMAN: I feel sure you will join with me in thanking Mr. Lewis for his interesting paper. My personal experience of the difficulties surrounding the opening up and civilizing of Africa enables me to appreciate Mr. Lewis's very pertinent remarks regarding slavery, a difficulty that cannot be ignored by the missionary or the explorer. Mr. Lewis very truly says, "Freedom without principle means anarchy and confusion; for this reason domestic slavery cannot be abolished by force." We all desire to see the slave trade promptly and vigorously stamped out, And if more gentlemen of Mr. Lewis's calling were to discriminate, as he evidently does, between "domestic" slavery and the "slave trade," it would not only lighten the burden of the administration under which the missionaries live, but it would tend to promote the noble work which they themselves have so much at heart. Unfortunately, many well-meaning and earnest men frustrate their own efforts by

provoking through misplaced zeal the natives to present a hostile attitude, which might be prevented by the tact and wisdom so evidently displayed by Mr. Lewis. It only remains for us to join in thanking Mr. Lewis for his very interesting paper, and I am sure I have your approval in doing so.

THE ARTESIAN WATER-SUPPLY OF AUSTRALIA FROM A GEOGRAPHICAL STANDPOINT.*

By W. GIBBONS COX, C.E.

In treating upon the artesian water existing in the crust of the Earth in Australia, and the changes, present and future, incidental to its utilization upon the surface, more particularly in neutralizing the effects of the droughts to which the country is subject, it will be necessary to consider, if only briefly, the evolution of the continent during the geological phases through which, according to the most recent scientific research (especially that of the late Queensland Government Geologist, Dr. J. L. Jack), it has passed.

A central sea still existed in Mesozoic times, and was then filled up to a large extent by sediments (in Cretaceous times). These were subsequently (in Tertiary times) uplifted, and formed with the Palæozoic rocks a united continent. Further depression again submerged part of the coastal and central land, and these depressions were followed by a re-elevation. The climate during these periods of depression was doubtless much more moist and equable than at present. Before the deposition of the Cretaceous sediments there were mountain chains on the eastern side of Australia, almost alpine in character, with which the ranges of the present time are insignificant in comparison. Those mountain chains induced great precipitation of the water held in suspension in the clouds by which they were, in all probability, constantly surrounded. Before the beginning of the Cretaceous period —of the deposit of the Cretaceous formation of thousands of feet in thickness, consisting of alluvial strata, including the artesian water-bearing rocks—the whole continent had subsided, but the strata lying above the Cretaceous, which has been proved in Queensland to be over 5000 feet in thickness, shows the great length of time which must have elapsed in the formation of the present surface, the great tablelands, or rolling downs, of the interior. Taking into consideration that during the Tertiary age there was a great deposit of rich alluvial soil from the decomposed material of the ranges, and also considering the climatic conditions prevailing, it is easy to imagine that the vegetation was of a most abundant and luxurious character, especially in the vicinity of the lakes, swamps, and inland rivers. Those conditions resulted in the development of a great variety of animal life, notably of an herbivorous

* Read at the Royal Geographical Society, January 29, 1902. Map, p. 668.

fauna of gigantic proportions, the fossil remains of which have been found in the Post-Pliocene strata in the Darling Downs of Queensland and in the interior of South Australia. Those remains marked, no doubt, the course of ancient rivers, or the position of ancient lakes. The changes in the physical conditions of the country which brought about the gradual extinction of the huge fauna can, I believe, be accounted for by natural forces. As the high mountain ranges became lowered, and the precipitation of torrential rain became thus reduced, when the river and lake sources of moisture had become destroyed, the climate underwent a gradual change. A condition of excessive moisture was followed by one of partial aridity; the long succulent, luxurious

"TRAVELLING" SHEEP TO WATER DURING A DROUGHT, QUEENSLAND.
(*From a photograph in the collection of the Royal Colonial Institute.*)

vegetation gave way to a shorter and less prolific growth, till finally aridity ruled to the extent it does in inducing the disastrous droughts of the present day. Those droughts are abnormal to the general condition of the country. During good seasons of fair rainfall, averaging on the great plains of the interior about 20 inches per annum, the indigenous grasses of the present day are of so highly nutritious a quality that animal stock of all kinds thrives in the most perfect manner—so much so that a pastoral, wool-growing, and cattle industry has been established which rivals in extent and importance that of any other country in the world. During the prolonged droughts which, however, occasionally set in, the condition of the interior undergoes a great and disastrous change. The water in the creeks and

lagoons has become exhausted by soakage—a great factor in results—and evaporation; the herbage has shrunk and lost its nutriment; the live stock is reduced to a precarious living by feeding on tree-growth, or to being "travelled" to, in many cases, far-distant localities, if such indeed be found free from the general aridity prevailing. The influence of these droughts upon man is physically and morally bad, especially in contemplating the present condition of the country to that ruling in the normally favourable seasons, and it is only by the exercise of indomitable will, self-denial, energy, and resource that the difficulties incidental to a prolonged drought are combated, and in a manner tided over.

It is evident that in order to combat these droughts, which are the result of a cessation of the normal rainfall, artificial irrigation must be resorted to. There are two sources of supply which may be drawn upon, *i.e.* that of rivers, and that from underground, principally in the form of artesian water. Irrigation from rivers has been largely availed of in various parts of the world. The great irrigation canals and systems of India are the most noted under British rule, and were made at an enormous cost by the Government of India. In Egypt extensive works have been and are being carried out by the Egyptian Government. In America—in California and Utah especially—irrigation has been adopted on a very large scale in connection with river-supplies, and it is, I think, very probable that equally intense culture exists in those states as in China, and certainly the art of irrigation has attained in the former a much higher standard. In Spain, Italy, and other parts of Europe, irrigation has been largely availed of, and also, to a limited extent, in South Africa and Australia, such as the Douglas irrigation, Vaal river, and others in the former, and Mildura and Renmark in the latter country. In all these works the source of supply has been flowing rivers, whereby a constant and ample flow is maintained through properly constructed channels and minor irrigation ditches.

For the purposes of irrigation—and this I wish to particularly emphasize—the rivers of Australia are, unfortunately, few in number. The one great river system, the Darling-Murray, which never runs dry. is limited to one section of country only; other flowing rivers consist of comparatively short courses emptying into the ocean at various parts of the coast, but the interior rivers and creeks—those of the great pastoral plains, although they carry great quantities of water in the "wet season" or during flood times, soon run dry during droughts, through quick soakage and evaporation. An effective conservation of the water held in these interior rivers and creeks during flood times by costly reservoirs and canals will be, I am afraid, beyond economic financial possibilities for a long time to come.

As I have intimated, there is, I believe, a remedy for this state of things—that is, in a fuller utilization of the artesian water which lies

conserved in the crust of the Earth, and which may be readily procured at a comparatively low cost.

Irrigation from underground supplies has long been practised, especially in India, Algeria, and America. In the Madras Presidency alone, according to official reports, the land irrigated from wells amounts to millions of acres, yielding a large revenue. It is a fair estimate that there are in Central Asia and Persia at least 200,000,000 persons depending solely for their food upon areas irrigated by water drawn in the most primitive manner from underground sources in the form of wells, springs, or drainage conduits. An examination of the records,

FLOODED COUNTRY, FROM AN ARTESIAN BORE.
(*From a photograph in the collection of the Royal Colonial Institute.*)

habits, and customs of the communities so supplied will show an exceptionally elaborate system of care and maintenance of the wells.

In Algeria, especially in the great Desert of Sahara, artesian water has achieved wonderful results. The transformation produced by artesian water upon the sandy wastes of Algeria as described by the distinguished French engineer, M. Tournel, is amazing. The most remarkable example of reclamation by means of artesian water is found in the desert provinces. The area officially given is 329,415 square miles, one-half of which belongs to the Sahara, or desert. The population, including 260,000 Europeans, is about 3,688,000. Cultivation by the means of flowing well-water has been sedulously fostered by the French Colonial Government for both political and economic reasons. Wells as a means

of reclamation were systematically commenced in 1857, the French engineer M. Jus having demonstrated in 1856 that the desert was endowed with large supplies of underground water. The total number bored since that date is nearly 15,000, and they are of moderate depth. The waters are collected in small ditches, which convey them to the vineyards, date trees, and fields of durra, millet, wheat, etc., which comprise the chief products. In all about 14,000,000 acres have been reclaimed in this way.

Irrigation by means of bored wells has nowhere attained greater practical or more favourable economic results than in America, of which country I can speak personally from an experience extending over some years. Artesian wells in the United States are reckoned by thousands, extending from Montana and North Dakota to the northern portions of Texas. Besides in the states of North and South Dakota, Wyoming, Nebraska, Colorado, Kansas, Idaho, California, New Mexico, and Texas, in which their numbers are almost incredible, in the northern and eastern states likewise an immense number of wells have been bored. Surely such a result as that, achieved by individual efforts in the utilization of underground water in so highly practical a community as that of the United States of America, speaks volumes as to the value of artesian water, and indicates the possibilities in that direction both in Australia and in those parts of the British Empire which have not had the benefit of the borer's drill.

The artesian rocks which contain that water form a part, as before stated, of the Cretaceous formation, and are composed generally of an open porous sandstone highly favourable to the absorption and passage of water. In Queensland (which State, on account of the greater extent of the utilization of its artesian supplies, may be fairly taken as a representative Australian one) they have been proved vertically to 700 feet, but are, in all probability, of a much greater thickness. They lie at depths below the surface varying from the outcrop level to over 5000 feet. They are freely developed in Western Australia, South Australia, New South Wales, and Queensland, and in the latter state lie under nearly two-thirds of the total area of the state, or 445,332 square miles. The rock outcrop, or water-intake, areas, have, according to special surveys made under the direction of Dr. J. L. Jack, the late Government Geologist, a combined length of over 1000 miles, with a minimum width of 5 miles, and one continuous outcrop in the northern part of the state has a length of 280 miles, with a minimum width of 90 miles. These outcrops are situated on the declivities of the ranges in country more or less above the plains of the interior, thus fulfilling the conditions necessary for an artesian well, which is a shaft bored through impermeable strata until a water-bearing stratum is reached, when the water is forced upwards by means of the hydrostatic pressure due to the higher level at which the

main, or supply, water was received. Over the intake areas there is a mean annual rainfall of about 26 inches.

The artesian rocks, with the whole Cretaceous formation, have assumed, after great geological changes—after upheavals and depressions of the Earth's surface—an undulating curvilinear form from their outcrop to their termination in the bed of the ocean. This is proved by borings to artesian water, along a line of country of over 1000 miles in length,

TOWN BORE AT CHARLEVILLE, ONE OF THE INLAND QUEENSLAND TOWNS RETICULATED BY THE BORE-WATER.

(From a photograph in the collection of the Royal Colonial Institute.)

in which, with a comparatively level surface, the depth varies from 200 to over 5000 feet.

In addition to the Cretaceous formation, there is, according to Mr. E. F. Pittman, the Government Geologist of New South Wales, every reason to believe that the Triassic or Jurassic coal-measures may lie under the Cretaceous formation, and writes that he would "even go so far as to suggest that the porous strata of the Frias-Jura formation may

constitute the chief storage beds of the artesian water supply of Australia." Such formations yield large flows of artesian water in the states of Nebraska, Texas, and Kansas in America, and a similar flow takes place in the Moree and Coonamble bores in New South Wales, which are in the Ipswich (Queensland) coal-measures, or Jurassic formation. This prediction of Mr. Pittman promises an immeasurable addition of artesian water to that already proved to exist in the Cretaceous formation, and affords further evidence of the great importance of a full and systematic development of the supplies.

According to the last Government Report, by Mr. J. B. Henderson, Chief Engineer of the Water Supply Department, the total number of bores in Queensland, including sub-artesian or non-flowing wells, is 891. Of these 6 per cent. only were made by the Government. The total aggregate number of feet bored was 1,066,605 feet, equal to 202·01 miles. The average depth per bore is 1197 feet. The total continuous yield from 532 bores at which the flow is known or estimated is, officially, totalled at 351,295,254 gallons per diem; 129 sub-artesian wells are estimated to yield by pumping 6,300,000 gallons per diem. There were sixty flows of over 1,500,000 gallons per diem, ranging as high as at Cunnamulla 4,500,000 gallons, and at Coongoola to 6,000,000 gallons per diem. The estimated daily requirements of Brisbane the capital city, with a population supplied with water, is 4,393,000 gallons, so that some of the single bores in the interior, discharging through a six-inch pipe, would meet the demand, and two-thirds of the total outflow would supply the daily needs of London itself.

I think the above figures show that there can be no doubt as to the artesian resources of Australia, and that they compare very favourably with those of other countries; but of the full systematic utilization of even the present outflow, I do not feel justified in speaking favourably, nor does there appear to be any indication on the part of the Governments, or of private individuals, to remedy the existing defects in the administration of this valuable national asset. It is to be hoped, however, that the Federal Government will move in this matter.

The following will show the position of artesian supplies, and their general treatment in Australia at the present time. Before artesian water was tapped, the country, during droughts, was the despair of pastoralists, as, from lack of rain, feed for stock had become exhausted; the creeks had dried up and the country had become waterless. By means of artesian flows over an area of about 120,000 square miles, as shown on the hand-map, and, as stated, of over 1000 miles in length, this condition has been somewhat remedied, although the number of bores made gives only 1 to every 148,440 acres of the proved artesian areas. Channelling has been made over the properties, so that the stock are provided at least with abundance of water—in fact, in some cases, too much of it—the low-

lying lands being converted into a mere swamp, but irrigation from the bore-water, even on a limited scale for growing feed for stock, has been, as a rule, neglected, although in many parts of this western country, three crops of lucerne and other fodder have been grown in the year. We know what valuable results have been attained by irrigation in other countries, and I think there is no doubt that if the part of Australia in question had been a closer settled and more of an agricultural one, the water would have been utilized long ago. In South and Central Queensland, under close cultivation, nearly two thousand of acres are irrigated by bore-water, and very successful

MAXMILTON No. 1 BORE.

(From a photograph in the collection of the Royal Colonial Institute.)

farms under similar irrigation have been inaugurated in New South Wales, notably the Pera bore Farm, Bourke district.

The last report of the Chief Inspector of Stock for Queensland shows a loss, mainly from droughts, of 4,887,294, or 32 per cent. of sheep in twelve months, ending with 1900. Since the end of 1892, when the number of sheep reached the maximum, the total of nearly 22,000,000 had become reduced to 10,339,185 on the last day of 1900, and those had been saved mainly by artesian water, for although the creek water had dried up there was still, in many districts, sufficient nutriment left in the grass to tide over the difficulty by the stock quenching their thirst in the bore-water. In New South Wales the total sheep at the end of 1891 was 61,831,416. By the end of 1899 the number had

become reduced to 39,612,126. The loss of sheep in nine years up to the end of 1899 was 31,340,000. Cattle had also been lost to a lamentable extent, 975,645 being the reduction for 1900 in Queensland alone.

These are very serious facts, both from an economical and a humanitarian point of view, and call for an earnest national movement. If the pastoralists cannot afford, under the terms of their holding, to fully utilize the artesian water, but must rely upon a rainfall, it is, I think, obvious that irrigation will have to be undertaken by Government.

In strongly advocating the use of artesian water as the most feasible means of combating the droughts, I will give a comparative estimate of the cost of reservoir (dam) making and artesian wells. In doing so I may point out that the Government of Western Australia (where I passed two years, 1896-97, partly under the Government in connection with artesian supplies) is carrying out works to supply water to the Coolgardie gold-mining district by means of a great reservoir near Perth, on the coast, and a pipe-line of over 300 miles long. The capacity of the scheme is five millions of gallons only, to be delivered daily at Coolgardie at a cost which will verge upon three millions sterling. Some of the Queensland bores, costing a few thousands of pounds, would fill the reservoir at Coolgardie *daily*, but then there is no artesian water under the Western Australian goldfields such as exists in such prolific quantities in the interior of Queensland and other portions of Australia.

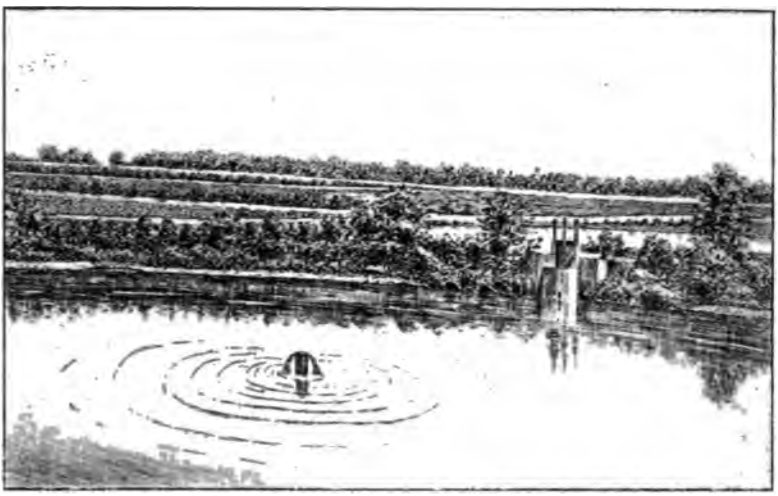
The cost of the Queensland bores, yielding, as stated, over 351 millions of gallons daily, works out as follows: Number of bores, 532; average depth per bore, 1197 feet = 636,804 feet at twenty-five shillings per foot—a fair average price—£796,005. The cost of reservoir (dam) making is as follows: At Taabinga, Queensland, which may be fairly taken as an example, excavation for reservoir and construction of dam, £314; area at high-water mark, 9·8 acres; maximum capacity of reservoir, 11,400,000 gallons. This conservation takes place usually only once a year, the accumulated water being doomed thereafter to deterioration and final exhaustion, quickly so, sometimes, during droughts. Many of the artesian outflows would fill the reservoir every two or three days with good naturally filtered water all the year round. So that, although the initial cost of the reservoirs is less than that of the bores, the quantity, reliability, and value of the water-supply of the latter is immensely greater.

Irrigation from these comparatively small reservoirs is out of the question, and they are only justifiable for the purposes of watering stock outside the artesian areas.

As regards a system of irrigation canals, besides the cost of the canals themselves—which would have to be of large dimensions—a succession of costly conservation reservoirs would have to be made in

order to maintain a head of water in the canals, for there are no flowing rivers at command. In Western Australia the Goldfields Water Conservation Department were making, whilst I was in the Government service, a series of reservoirs in various outlying parts of the fields, costing thousands of pounds each—the price of one Queensland bore—the inside of the reservoirs being lined with expensive concrete to prevent soakage. These reservoirs were designed, and are used solely for road traffic among the mines, irrigation forming no part whatever of the scheme.

I am convinced that irrigation from the rivers and lakes of the section of country in question cannot be adopted economically, and that



IRRIGATION FROM AN ARTESIAN WELL, TULARE, CALIFORNIA.

the only alternative lies in a greater increase of artesian supplies, and by their aid the adoption of systematic irrigation (for at least fodder for stock), and thus induce a larger pastoral and agricultural population to settle on the land.

In tracing artesian water from its source to its outlet in the bed of the ocean, we find the following facts. By a natural process, through the action of the sun's heat, the ocean gives up distilled water in the form of vapour, passing into clouds, which, on impinging on the ranges or higher lands, or under other atmospheric conditions, resolves itself into rain. This rainfall, coursing down the surface declivities of the country, is intercepted by the great areas of the outcropping porous artesian rocks, passes into and works its way along them, and in quantities of such enormous collective volume that they are incalculable upon any data we have, or are likely to have, at our disposal. Incidentally I may point out that the highly absorptive nature of strata

of the Earth's crust is shown by the chalk of the Cretaceous formation of the London basin. By elaborate research it has been found that each square mile of dry upper London chalk, one yard in thickness, contains nearly three millions and a half gallons of water, but the same quantity of rock is capable of absorbing, and it would contain if saturated, upwards of two hundred millions of gallons. This chalk stratum has a superficial area in England of 3794 square miles, upon which the rainfall is nearly equal to four thousand million gallons daily or equal to five times the summer stream of the Thames. Wonderful as its capacity for absorbing and retaining rain-water may be, I do not, however, think this chalk excels in those respects the artesian rocks of Australia, and it is far less free in giving off its water.

Artesian water, being under inherent pressure from a portion of its volume, will rise to the surface through any vent which will relieve that pressure. It thus overflows the surface in borings at all points at which the surface-level of the bore is below that of the outcrop of the water-bearing rocks. It is easily conceivable that sufficient water might be tapped by a great increase of artesian borings in Australia, which would provide permanent rivers and creeks in the interior from which systematic irrigation could be carried out. A portion of the waters of those rivers might possibly reach the sea, as did the waters of the rivers of old in the geological periods long since passed away. In any case, with a greatly increased outflow from artesian sources, there would be greater evaporation, increased moisture, and a far more equable climate than now prevails. Increased evaporation would complete the cycle, and prove, as I have indicated, that although the ancient rivers have been obliterated, the rainfall on the existing higher lands is sufficient to supply the underlying porous strata of the crust of the Earth with an incalculably enormous volume of water, the utilization of which on the surface above is only dependent upon the simple mechanical means at our disposal for tapping it.

The late Dr. Bancroft, of Brisbane, for whose opinions I have always had a reverence, propounded the question as to whether the action of the water from numerous bores in the interior of the country would induce moisture sufficient to coalesce with the rainy atmosphere of the coast, and thus determine rainfall in that interior. This question has often occurred to me in my practice as an artesian engineer, which has been in the driest parts of the interior country. In all irrigated or in all lake districts, with their accumulation of inland surface waters, the rainfall is greater than in the adjacent waterless country. This I found to be the case during a visit I paid some years ago to the chain of reservoirs which supply the city of Manchester, England, with water. With a heavy periodical rainfall, it was found that during spells of dry weather in the adjacent districts rain fell invariably, more or less, over the line of reservoirs. I remarked the same effect in many sections of

the Western States of America, where irrigation from bored wells on the closely settled farms induced a larger and more regular, although light, rainfall than that which took place in the unsettled prairie lands of the country.

When I first began to practise as a subterranean water-supply engineer in Australia—in the pioneering times in 1877—the lack of surface water in that fine country, and the evils attendant thereon, was, after an experience of Great Britain and five years' practice in the United States of America, a revelation to me. In the pastoral districts of Australia, in which artesian water has been since obtained, great benefits have accrued. The water has, in many cases, flowed in a natural course for over 50 miles from the bore, and it is now ready for the fullest utilization; but irrigation for the purposes of pasturage or crops is, as I have indicated, only in its initiative stage.

Many inland towns of the Downs country are supplied by reticulation from the bore-water under its natural high pressure. Single bores are there supplying an ample and constant supply for domestic purposes, and also for vegetable and flower-gardens *ad libitum*, and one scarcely knows which to admire most, whether the fruit trees in bloom or the blanched linen on the laundry-women's lines. The beneficial change already induced by the use of artesian water is apparent on every hand in those districts where it has been largely obtained. Live stock have been saved by thousands, and man made better, physically and morally, and with a fuller utilization of the water, the one great drawback of a great country will be largely neutralized.

Lord Lamington: I believe, in almost every case where tried, bore-water after two or three years deposited such a sediment as proved harmful for agricultural purposes. Of course, water differed in the several bores, and some might be found adaptable. It seemed certain that lands that only required irrigation to make them fertile should, either by this method or by conservation of water, be turned to better use. But in the meanwhile, with hundreds of thousands of acres of rich lands on the coast, with a fair rainfall and more agreeable conditions of life, and which yet required to be settled and developed, it was unlikely that agriculture on a large scale would be taken up in the western country.

Sir T. Fowell Buxton: I think, from all we have heard, the prevailing opinion is that the artesian supply will go on perpetually flowing. We know if we have any receptacle in England, such as a gardening water-pot or anything else, and we draw from it, we run it dry. Well, I have never heard anything on that point, but when we are dealing with the water-supply of a great continent and talk of creating large rivers by which to reach the sea, it becomes a very important question whether there is any chance of running it dry. So far as I know, there was no solution of it in South Australia in my time. The object seemed to be to make a reasonable supply along certain tracks along which cattle and sheep might be driven. Now, it was considered very important to establish a cattle-track between Queensland and South Australia, going from the railway near Lake Eyre into Queensland to the head of the railway there, and the scheme which was more or less begun in my time was to try and establish an artesian well at every 20 or 25 miles.

I do not know whether that has been maintained, or whether it has been taken up by the Government of Queensland on that side. But there certainly was no attempt, so far as I understood it, to produce a supply, a big enough irrigation scheme, that would mean cultivation of land. It was only attempted for the supply of cattle; large troughs, as I saw them in South Australia, were established for the feeding of cattle, and I think I was surprised and rather disappointed by seeing a large chute, almost as high as some of those we have been seeing pictures of this afternoon, a considerable chute going up nearly as high as this room, yet apparently, when used for irrigation, go such a little way. I remember seeing a garden just south of Lake Eyre, where an attempt was made to produce dates, and there were certain gardens laid out with date palms and other things; but the irrigation seemed to go such a small way, it may be five, or six, or eight, or ten acres, but it did not extend to anything like a large area, and apparently it would have gone if the supply had been large enough. I hope I have made my question clear, and have not occupied too much of your time.

Dr. H. R. Mill: There are several points in this most interesting paper on which I should like to speak, and I should like to put my remarks in the form of questions, or, at least, to ask the opinion of Mr. Cox upon what I have to say. Of course, the importance of the subject is apparent to all geographers, and I think Mr. Cox deserves special thanks for bringing forward so very clearly the enormous importance of underground water-supply in the case of this particular continent of Australia. But then comes the question, Is that water-supply going to be continuous? Is there under the surface of Australia a great accumulation of water stored up from remote periods in the past? That is a theoretical point which, to my mind, is of vast importance. I do not know, but there were several statements in this paper which suggested the idea that the author possibly considers that the water stored up in these rocks dates back, some of it at least, to comparatively remote geological periods. Now, from the study of the general phenomena of physical geography, one is inclined to believe that the condition of things should assume a state of equilibrium; that the storage of water in the strata would go on to a certain point, beyond which any fresh accession would be counterbalanced by loss, either a flow off into the sea, or perhaps by the rising of the water to the surface and its removal quietly by evaporation; and I would put it as a question whether it is not extremely probable that the available supply that can be drawn from artesian wells is not simply that proportion of the rainfall of the country which percolates into the soil. We know that in our own country there is an immense quantity of water saturating the chalk which lies beneath the London clay, and that water has been taken from that supply to a greater extent, I suppose, than in any equal area on the surface of the Earth, and we know that as a consequence of the flowing of artesian wells, and the pumping of non-flowing bores, the level of saturation in the chalk has been steadily going down. The amount of water removed now almost entirely by pumping—because the artesian wells no longer flow on the surface—is probably in excess of the amount of water brought in by the rainfall, hence the wells have always to be deepened in order to yield. The same, I am very much inclined to believe, will be the case in Australia if any particular artesian basin is treated as if its supply were inexhaustible; but then we must remember that even if that is so, the amount, though not inexhaustible, and though perhaps not even incalculable, is still so very large that it will admit of an enormous amount of development before these limits begin to be practical problems. There is another point of very great interest which is mentioned in the paper, and that is with regard to the effect of a surface of water in attracting rainfall. Mr. Cox referred to the reservoirs supplying Manchester.

I suppose he meant the Longdendale reservoirs, and there it would be easy to ascertain whether it is really the case that the existence of this water surface has produced any increase in the amount of rainfall, or even in the frequency of showers. Our usual experience is that when you have a level surface of water, the amount of evaporation is greater than any increased rainfall that would be induced by the lower temperature of the water, which, of course, is the only way in which condensation would be produced on the surface. As a rule, we find a slight rise in the elevation of the land will produce a greater rainfall than a lowering of temperature over the surface. I have been extremely interested in the paper, and the practical outcome of it seems to be that, side by side with the utilization of the artesian water, we must go on with the study of the rainfall, which in Australia is perhaps more capricious than in any other part of the world, and so requires a longer series of years of observation in order to ascertain the average rainfall; in fact, I do not believe that as yet we know the true average rainfall of any part of Australia, because the records have not yet been kept up long enough.

Mr. Langler: Might I inquire what is the basis of the remark made in this paper with regard to the absence of artesian water in Western Australia? Is it based on geological theory, or is it on actual experience?

Mr. Gibbons Cox: In regard to the remarks made by Lord Lamington, I think irrigation water, that is to say, all water for irrigation purposes, must vary in quality; even some of the best of the river-water is not good for irrigation. And, further, a good deal of the water that comes from these bores, on being exposed to the air for a time, does very well for irrigation. I think it is a local matter to a great extent. When we take into consideration that immense areas of land have been irrigated in Algeria, America, and Europe, I think there is every reason to believe we shall get the same results in Australia. As there is such an enormous area of artesian rocks in that country, there is, in all probability, a vast quantity of water adapted for irrigation. There may have been some cases in Queensland where it has not been a success, but that must have been because the water was not adapted for the purpose. I think you will find that neither the Government nor private engineers claim that all water is good for irrigation. Some is adapted for wool-washing, other is good potable water and for irrigation, and I do not think it is safe to assume that all the artesian water of Queensland is unfit for raising crops. Irrigation is only in the initiative stage. Of course we cannot be certain, but I am inclined to believe that the future will see a very extensive system of artesian irrigation.

In answer to Sir T. Fowell Buxton, with regard to whether artesian rocks exist in the Lake Eyre district; the most recent researches of geologists and engineers show that such rocks do exist.

Sir T. Fowell Buxton: My question was, Do they exist there exclusively, or almost exclusively?

Mr. Gibbons Cox: I do not know that; but in the Lake Eyre district there are remains of the old Cretaceous ocean, and certainly Cretaceous deposits took place there. Although the lake-water is salt, I think that in the future very fine artesian water will be obtained from below.

In reply to Dr. Mill, as regards permanence of supply; I do not think there is any doubt about that. If the enormous areas of artesian country are taken into consideration, the areas proved by actual boring down to the water-bearing rocks, which have given large flows of water; if you take also the outcrop areas as proved by actual surveys by the Government geologist, and the fact that there has been quite an average of certainly 20 inches of rainfall as shown by the

official gaugings of the last fifteen or sixteen years, you will get at such an enormous volume of water stored up repeatedly, or naturally conserved, in the ground, that to my mind the quantity is almost incalculable. Although we find that the daily flow in Queensland is 351 millions of gallons from 530 bores, that quantity is in reality a mere bagatelle. I think there can be no doubt as to the permanence of supplies providing the rainfall continues, and we have no reason to suppose it will not do so. Another matter is, that if you take into consideration the porous nature of the rocks of the crust of the Earth—even granite, as I have remarked, is so constituted — and that the Earth has been receiving rainfall from the very earliest times, it will be apparent that the crust must have been fairly saturated irrespective of the rain that has fallen in our time. The Earth is absolutely charged with water, and a portion, no doubt, of the artesian flows has been accumulating for ages. But we are inclined to think, from the fact of the water being comparatively fresh, that it is not in a state of utter stagnation, or, in other words, that as it is not highly impregnated with saline and other alkalies of the Earth, it is moving. The water (referring to the map) is, in fact, slowly passing down through the porous water-bearing rock until it enters the great Australian bight below the surface of the ocean, and also, in all probability, into the Gulf of Carpentaria. Further, as regards permanency, I think it will take very many thousands of bores before an effect is appreciably made on the supply. Dr. Mill said that, the draught having been very great on the London basin, the head of water had naturally been reduced, although it took a great many years to produce that result. Now, if we take the area—and I scarcely like to make a comparison of my native country with countries like that one—if we, however, compare the area of Queensland with the London district, and if we assume that the Cretaceous water-bearing rock of Queensland is highly porous (and it is a question in my mind whether it is not equally as porous, and equally as good a water-conveyer, as the London Chalk; it certainly parts with water more freely), the accumulation of water in that State is, as I have desired to impress upon you, so enormous that the comparison will not, I think, hold with regard to the London district.

With regard to the question Mr. Langler put to me as to Western Australia. The artesian rocks in that state are of a rather different nature. They are calcareous sand-rocks, belonging to the same Cretaceous formation, and are called Œolian sandstones. At Perth they have been very successful in boring, and have produced splendid water at a depth of 700 feet in the railway yard. It is a very fine flow—it is, in fact, so strong that the Railway Department could not use it all, but made arrangements with the municipality, the money paid by that body covering the interest on the cost of the bore. It has been found at Bunbury, on the south-west coast, and at Guildford, about 18 miles up the Swan river from Perth, where there are many fine flows. The Cretaceous belt is not confined to the south-western coast, but extends to Geraldton and Onslow, on the western coast, and they have it up here at Freycinet Point, and are also boring in the Kimberley district. Much of the artesian water in the south comes from the Blackall ranges. The northern district has had a bad name for dryness, but I think it extremely likely that artesian water could be obtained all over there. An amount of experimental work—and it may be to a great extent so called—has been left to private enterprise, the Government not having supported the matter as much as I think it ought to have done.

The Chairman: I think it is very encouraging for us to hear from Mr. Cox that he has great faith in the permanence of the water-supply of these artesian wells. Certainly that was not the opinion of everybody in Queensland when they were first started. When I was in Queensland, there was a good deal of doubt on

the part of some persons as to whether the supply would be permanent, and endeavours were made to prevent waste in the water. It was turned on at certain hours and turned off again. No doubt a better opinion has prevailed since then, and it is believed that the water-supply will be practically permanent. And, as Mr. Cox says, of course the number at present in Queensland, compared with the area of the country, is very small indeed. There are many interesting points connected with artesian wells which have not been touched upon, and about which perhaps a good deal is not known. I would remark on the extraordinary difference in the temperature of the water. I believe there is a very great difference indeed. That very beautiful artesian well at Charleville (?), to which the lecturer referred, and which I have visited on various occasions; the water comes out at a temperature of about 100°, and I believe it is very much higher in some other wells, and possibly lower in others. That water is utilized in various ways. For instance, there is a nice bath, where you can get a very good warm bath for a charge of a penny. Then there is a good deal of difference, I believe, in the taste of the water of these various wells, as is natural, as they come from different soils; but I believe most of the artesian water is quite palatable to animals, but a good deal is not agreeable to us to drink. I am sure you will all agree with me that Mr. Cox deserves our thanks, not only for his lecture on the artesian wells and the readiness with which he has answered all the questions put to him, but because long before this time he commenced to make a general study of the question of artesian supply, and I may say a great part of his life has been devoted to that study, and I believe with a great deal of success. I would ask you all to allow me to convey your thanks to him for the interesting lecture he has given us.

Mr. Cox: I am extremely obliged to you for the very kind way in which you have received my paper. It has been a great pleasure to me to read it before the Geographical Society, because it is a Society of very considerable scientific research and importance. The questions that arise out of this artesian water-supply are very great and very voluminous, but I think, as I said before, that there is immense quantity of water in the crust of the Earth which can be got out, and I believe it can be used for irrigation purposes to a very great extent.

Dr. R. Logan Jack, who was unable to attend, sends the following remarks on Mr. Cox's paper:—

Much credit is due to Mr. Cox for having so clearly drawn attention to the benefits of irrigation. There can be no doubt that at present all the surplus of the bore-water beyond what is drunk by stock is practically wasted, except for the slight improvement in the humidity of the climate which must result from the creation of a number of open water-bearing gutters. To cultivate rice on the low-lying grounds in the vicinity of the bores would improve the climate, as it has done in China and India, but Australian bushmen are not large consumers of rice, and the factor of freight to the market will determine whether the cultivation will pay. The question of the cultivation of fodder for the sheep will be looked upon by the squatter in the cold light of figures. He will cipher it up something like this:

"My bore yields, beyond what the stock drink, 100,000 gallons per day. What can I do with that? I could (after making reservoirs) pour 6 inches of water four times a year over 70 acres of land, and cultivate lucerne. As a continuous growth of lucerne may yield eight crops, or 12 tons per acre per annum, let me assume that my partial irrigation will yield four crops, or 6 tons per annum. My 70 acres will yield 420 tons, or 940,000 lbs.

"To keep a sheep alive for, say, 90 days in the year when the natural grasses fail, or the animal cannot reach them, will take 8 lbs. of fodder per day, or 720 lbs.

in the year. My whole 70 acres will thus tide 1300 sheep over the average annual period of drought. The capital value of my sheep is 9s. per head; thus 1300 sheep represent £582. What will it cost me to save 1300 sheep, value £582, which would otherwise be lost? I have my doubts about getting labour for the tropical west at coast or southern rates, and I must reckon up the capital value of reservoirs, etc., but say that my 420 tons of fodder cost me, as I believe is about the average on the coast, 25s. per ton, or £525; the difference between that and the £582 is very small."

With reference to the above, Mr. Cox writes—

In putting such words in the mouth of the cold-blooded squatter, I admit that every one of the figures I have supposed him to use may be erroneous, because I have little practical knowledge either of pastoral or agricultural pursuits. In many cases, however, I believe the squatter knows very little more about agriculture than I do, and no doubt he will seek expert advice on that subject from the farmer. Personally, I should be delighted if, when the two lay their heads together, they find some radical error in my *data*—much as, for instance, that eight crops of lucerne can be cut annually in place of four, or that the cost per ton will be only half what I have supposed, or that some other crop will be more profitable than lucerne. Nevertheless, I assume that the squatter, like the sensible man he is, will reason on such lines as I have indicated. If, with the help of the farmer, with co-operation, and perhaps with the assistance of the Government, he can see his way to make irrigation profitable, the whole country will benefit, and the full value, in place of an infinitesimal proportion, of the generous provision of nature will be realized. It is difficult to contemplate the present waste philosophically.

I am pleased to find that so high an authority as Dr. Jack confirms my opinion as to the capabilities of the present outflow of artesian water in Queensland, and that there is, in his opinion, a means of practical irrigation from that source.

			Gallons per diem.
The present outflow is			351,295,000
Allow for non-irrigable water 10 per cent. Allow for soakage and evaporation per diem 10 per cent.	20 per cent.	70,259,000	
Water used per diem by maximum number of sheep (year 1892)—22,000,000 sheep at two gallons each per diem		44,000,000	
			114,259,000
			237,036,000

1 inch of rainfall gives 22,622 gallons per acre.

20 inches per annum (allowing four waterings of 5 inches each) gives 543,485 gallons per acre; and 237,036,000 gallons per day would irrigate 151,191 acres with 20 inches of bore water per annum, or would irrigate at the rate of nearly 300 acres at each of the 532 bores treated upon.

THE RUSSIAN TIBET EXPEDITION, 1899-1901.

By Captain P. K. KOZLOFF.

In the spring of 1899 the Russian Geographical Society sent out under my direction an expedition to Central Asia and Tibet, organized with the money granted for that purpose by the Emperor. My

travelling companions were: Captain-Lieut. of Horse Guards, A. N. Kaznakoff, who for the first time undertook such a long and difficult journey; and B. Th. Ladyghin, who accompanied me for a second time. Kaznakoff undertook to make collections of insects and molluscs, while Ladyghin was to look after plants and butterflies; at the same time, owing to his excellent knowledge of the Chinese and Manchurian languages, as well as of the Turkish dialects spoken in Eastern Turkestan, he collected various ethnographical and historical materials, and was the intermediary in our relations with the Chinese authorities. Both could make surveys during the excursions which they undertook independently from the main caravan. I kept the geographical, meteorological, and natural history diaries, made the survey along our route, and determined the astronomical positions. At the same time I collected birds and mammals. In short, every one of us had his own sphere of activity.

The convoy of the expedition consisted of sixteen soldiers from different parts of Russia: eight grenadiers, one man from Omsk, six men from Transbaikalia, and one from Biysk. They were under the command of Sergeant Ivanoff, an experienced veteran who took part in three previous expeditions of Prjevalsky, Pyevtsoff, and Roborovsky. We had, moreover, two men from Transbaikalia who both had also accompanied Prjevalsky, one of whom was a very good taxidermist, while the other was an excellent hunter, and both could render some service as interpreters. For Mongolian, we had an interpreter from Transbaikalia, Tsokto Badmajapoff, who proved to be very useful in different ways. Beside their direct duties of looking after the animals and harnessing them, the men soon learned to help us in botanical and entomological preparations.

It was intended that the expedition should follow the Chinese or Eastern Altai from the Altaiskaya village to the eastern extremity of these mountains. Then it had to cross, wherever it would be possible, the eastern portion of the Great Gobi, and, through the province of Han-Su, had to enter Tsaidam, where further preparations would be made for the exploration of Eastern Tibet, which is known under the name of "Kam" (Kan-tsian by the Chinese). The return journey was to be made along the already well-known routes through the Alashan and *viâ* Urga to Kiakhta.

We all met in the Altaiskaya village of the province of Semipalatinsk at the beginning of July, 1899. The work went on with great energy. Ladyghin bought the camels, and all of us prepared the boxes and arranged our baggage. The men practised shooting, each man studying his own rifle. Scientific collections were also made, and we all burned with the desire to start on the great journey. We started on July 14 (26th N.S.), after a *Te Deum* had been sung, and I had read to my travelling companions the words of a telegram by

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which the Emperor and the President of the Academy of Science bade God-speed to the expedition.

Our caravan, which consisted of fifty-four camels, fourteen horses, and a small flock of sheep, was divided into seven sections, and slowly began its journey up the Bukhtarma river, along the foot of the forest-clothed Narym range. We had splendid weather, and there was plenty of work for every one. On August 1 (13th N.S.) the expedition crossed the frontier of Russia by the pass of Ulan-daba, and here it divided into two portions. I followed the high-road to Kobdo, which had already been visited by General Pyevtsoff, while my comrades Kaznakoff and Ladyghin took a more southern route lying nearer to the main axis of the Altai, with the purpose of exploring the sources of the Kobdo river and the Alpine lakes, of which there is a profusion in this part of the Altai. They had also to explore the fauna and the flora of these lakes, and took with them for that purpose a small canvas boat, as well as dredges, thermometers, and other hydrological instruments. My comrades came to Kobdo four days after my arrival thither, and their excursion was quite successful. They could not, however, make much use of the canvas boat, on account of the strong winds which prevailed during these days. Soundings were made on the two Kobdo lakes, upper and lower, which give origin to the Kobdo river. After a few days' stay in Kobdo, we resumed our journey.

Thanks to our good relations with the local Chinese authorities, they endeavoured to help the expedition in all possible ways. Our intention was to explore the Eastern Altai by means of a number of detached excursions which were to be made by my comrades, while the main body of the caravan would move along the northern slope of the Altain-Nauru. The Mongol inhabitants of this region were consequently warned beforehand by the Kobdo authorities, and they quite willingly gave us experienced guides and even transport animals for this purpose.

Soon after we had left Kobdo, and were near the temple Tuguryughen-kyure, situated on the Tsenkyr-gol river on the northern slope of the Altai, I sent out my comrade Ladyghin for the exploration of the southern slope of the Altai, parallel to the line of my journey on the northern slope. He had, besides, to explore the river Bulugun and ascertain whether beavers are still found in this locality, or only lower down on the Urungu river. My comrade brilliantly accomplished that commission. He crossed the Chinese Altai twice, explored the Bulugun river, and followed the southern slope of these mountains as far as the meridian of Lake Khulmu-nor, where he joined the main caravan, after having made 300 miles of survey. The eastern portion of the southern slope was explored by Kaznakoff, who crossed the route that was followed by Prjevalsky from Urga to Alashan, and afterwards went round the eastern extremity of the Altai, so as to meet me while I

PART OF EASTERN TIBET
Showing routes of Capt. P.K. Kozloff's expedition

was following the northern slope. As to myself, I followed the northern slope of the Altai, making at every step new discoveries, while we took advantage of the opportunity, which we did not foresee, of exploring the western part of the Gobi as well, and Ladyghin was sent out to cross the great desert in its western part, in the meridian of Ulyasutai and Su-chu.

The Eastern Altai has a general direction from north-west to south-east. On the meridian of Kobdo it must be divided, however, into two parts, widely different from each other. The western part is high, contains masses of glaciers and of snow-clad peaks. It is very rocky, covered with forests, and receives large quantities of rain and snow. To the east of Kobdo the Altai assumes a quite different aspect; it becomes low, and rarely reaches the snow-line with its high summits. Such summits are met with only on the meridian of Lake Khara-usu, and further east they become very rare. The main summits are Tabyn-khumustu, Khara-atsyrga, Ikhe-bogdo, and Baga-bogdo. The first is in the meridian of Kobdo; the second in the meridian of Lake Sharghin-tsagan-nor; the third is nearly in the longitude of Lake Orok-nor; and the fourth of Lake Tatsyp-nor. All these lakes are situated on the northern slope, and I passed them on my route.*

Owing to the dry winds coming from the south, *i.e.* from the Jungarian desert and the Gobi, the eastern Altai has but few forests and alpine meadows; nevertheless, the Mongols keep here large herds of sheep, cattle, and horses, and some camels. The gentle slopes of the mountains on the northern side are covered with excellent grazing-grounds, while on the southern slope, which is covered with a mixed vegetation, characteristic of both the prairies and the deserts, one finds very good pasture grounds for the camels, which are the chief means of livelihood of the Mongolian natives. Neither of the two slopes of the Gobi-Altai, as I name the Chinese Altai, may be said to be rich in rivers. The tree-vegetation of these mountains is poor as a rule, and only the slopes of the Baga-bogdo are a little better off in this respect. In the gorges of these mountains we found a considerable quantity of the Euphrates poplar (*Populus euphratica*), and three or four different species of bushes, as well as some thickets of willows. As to the animal life, we did not find a great variety of species, but considerable quantities of wild sheep were seen. In the valleys of the northern slope we found large flocks of antelopes (*Gazella gutturosa*, *G. subgutturosa*, *Saiga tatarica*). Very often we saw also large quantities of wolves, foxes, and hares.

* This part of the journey was described in letters published in the *Izvestia* of the Russian Geographical Society (*Geographical Journal*, January, 1900, p. 56). The main point of interest, for the geographer, of this part of the journey is in its having established the *border-range character* of the Sailughem range.—P.K.

At last we reached the wells of Chatseringhi-huduk, where we stayed for some time for the arrival of Kaznakoff, and the preparation of the collections which had to be sent back to Russia, together with reports on the work of the expedition and correspondence. Kaznakoff soon joined us, after having most successfully accomplished his journey. He had covered nearly 600 miles with his survey, which he connected in two places with the surveys of Prjevalsky, and he had passed round the eastern extremity of the Altai. In this way the Gobi-Altai was explored all round, and crossed several times by the members of the expedition. Altogether, we had covered nearly 2900 miles with our surveys, and made rich collections in natural history, ethnography, and the archæology of this part of Mongolia.

We had now to explore those parts of the Great Gobi which had hitherto not been visited by any European, and were considered almost entirely inaccessible. In the western portion of the great desert, Ladyghin was already making his explorations, in those parts of it which lie between the route of Potanin, *viâ* Etsin-gol to the Altai, and the imperial route from Hami to Su-chu. Kaznakoff and myself had now to explore its eastern portion.

We left Chatseringhi on December 1 (13th N.S.), 1899. For many hundreds of miles we had before us the renowned desert of the Gobi, the unknown parts of which have been recently narrowed more and more under the invasion of the Europeans—surveys having already been made on its western and eastern, northern and southern borders. I took for our main caravan the meridional route leading to Lan-chu, while Kaznakoff went at the same time in a diagonal direction—first towards the lakes which are formed by the Etsin-gol river, and thence to the encampments of the Alashan prince. He had thus to explore the most difficult central part of the Gobi. This bold journey could only be accomplished after we had collected much information about the character of the region, and owing to the excellent relations which we had formed with the Mongolian princes and their subjects, who did their utmost to help us in our difficult enterprise.

Want of space will not permit me to describe in more detail the Gobi, the character of which has in reality nothing in common with what we find in earlier descriptions. The Gobi was usually represented as a flat land covered with sand, showing no signs of hills, except in its western parts, where it was crossed by Potanin, and where mountains running eastwards and south-eastwards were represented on our maps. It appeared, however, that all the northern part of the Gobi, for about 200 miles southwards, on the routes of both Kaznakoff and myself, represents a country which is crossed from west to east, and from north-west to south-east, with more or less high

mountains, undulations, and ranges of hills, in the valleys and gorges of which one finds—not frequently, of course, but still occasionally—nomad Mongols with their herds of camels. This part of the Gobi is everywhere easy of access, and is traversed in all directions by routes provided with wells which contain sweet or slightly brackish water.

The southern part of the Gobi, on the contrary, represents indeed a barren desert, covered with masses of sand, and only occasionally intersected with low ranges of hills, of which the highest on my route were the Yebarai hills. The crossing of the Badan-chirin sands cost me a good deal, because all our riding-horses died one after the other from want of grass and the fearful cold, although we had taken with us some corn to feed them. We were thus compelled to ride on camels, and consequently suffered at the outset from giddiness; in fact, we preferred to walk and thus keep ourselves warm.

The central part of the Gobi, which was explored by Kaznakoff, is also hilly in its northern portions and sandy in the south; but my comrade succeeded in crossing it quite successfully, thanks to the Mongols, who willingly gave them the very best camels, and helped them to support the fearful cold and other difficulties.

The western portion, which was explored by Ladyghin, also proved to be very interesting. He had to cross a still higher hilly tract covered by ranges of mountains, large and small, having as a rule a south-eastern direction, and separated from each other by broad dreary desert valleys covered with gravel. He found no sands at all; only when he was already near to the cultivated region upon which the town of Su-chu is situated, he had to cross a narrow strip of sand barkhans (dunes), named Narin-hulusu, covered with low hard rushes; this belt of sands stretches for a long distance further east. Nearly in the centre of the desert he crossed and explored a fairly high mountain range, which is known to the Mongols by the name of Aty-bogdo and Koku-tomyrty. It is a high and narrow range of hills, which, notwithstanding its position in the centre of the desert, proved to be rich in animal and vegetable life. In all the gorges of its northern slope there are small streams, springs, and wells, round which one sometimes finds thickets of *tograk* wood (*Populus euphratica*) together with various bushes, of which the tamarisk and one species of willow, both covered with clematis, succeed best. The *Nitraria Schoberi*, and various species of *Lycium*, *Myricaria*, roses, *Salsola*, *Glycyrrhiza*, *Poa*, *Panicum*, *Amaranthus*, *Centaurea*, *Lactuca*, *Statice*, *Saussurea*, *Polygonum*, several Chenopodiaceæ and *Orobanche* also appear in quantities. Besides, in all the gorges one finds thickets of rushes, and on the slopes of the mountains certain species of rhubarb, much liked by the Mongols, while the steppe-grass (*Stipa orientalis*) attracts every year a number of Mongols from the Ederen region.

The animal life is also fairly varied and richly represented. One finds here in the valleys the *khulan* (*Asinus onager*), the wild camel (*Camelus bactrianus*), gazelles (*Gazella subgutturosa*), and in the mountains plenty of foxes, wolves, argalis, roebucks, and even some bears. My comrade, however, did not meet with any of the latter, although he was told that they live in this neighbourhood and feed upon rhubarb roots, which are also considered a delicacy by the Mongols, who bake them in hot ashes. In the thickets of the valleys my comrade found the *Uklik* (*Caccabis chucar*), the Bearded Titmouse *Panurus biarmicus*, a species of the *Alaudula*, some Saksaul sparrows, and so on. He was told that formerly bears were also found in this neighbourhood, but had disappeared.

After having thus completed the exploration of the Gobi, which was crossed in three different directions, so as to leave no unexplored region in the great desert, the members of the expedition hurried to the meeting-point, which was the Buddhist monastery Chortan-tau, situated near to the town of Sinin, on the Dai-tun-ho river. In this monastery, which is located in a beautiful, picturesque, and woody gorge, my great teacher, N. M. Prjevalsky, stayed on several occasions, and during his fourth journey I visited it as well. I expected to meet with a good reception in this monastery from the lamas, who so highly respected my late teacher, and I was not mistaken. Ladyghin came to Chortan-tau one month before me, and as soon as the lamas learned that he was a member of an expedition conducted by a pupil of Prjevalsky, and that the expedition would soon reach their monastery, they very kindly managed to set apart certain buildings for our reception. Both myself and my comrade, Kaznakoff, as we were passing through the town of Lan-chu, had the pleasure of making the acquaintance of the members of the China Inland Mission, Messrs. Belcher and Fiddler, who were extremely kind to us, and helped us in different ways. When I reached the above-named monastery, the Ghegens received me most cordially, and vied with each other in inviting me to dinners and to divine services, and in showing me their temples. Taking advantage of our stay at this spot, I made large collections of birds and mammals, and left here part of my baggage.

In the mean time I sent Ladyghin, and afterwards also Kaznakoff, to Sinin, to the governor of the province, to have a talk with him about our further journey, to settle all details, and especially to get the mail from Europe. At Sinin Ladyghin could not refuse the hospitality most kindly offered to him by Mr. and Mrs. Robinson, members of the China Inland Mission.

At last, leaving part of our collections with the lamas in the monastery, I left this place and went with my caravan to the town of Dan-gher, where we all met. The Governor of Sinin gave our expedition all necessary orders and letters of introduction to the local

Tibetan princes, who are under the Sinin governor. He also aided Kaznakoff in sending a caravan with provisions to Tsaidam. In Tsaidam we stayed at the monastery Barun-tsasak, and in the expectation of spring, we prepared everything for our Tibet journey. A meteorological station was built, and part of our collections was left at this depôt, as also all our camels. Four men from our convoy, under Sergeant Ivanoff, had to remain at the depôt, and Sergeant Muravioff was entrusted with the meteorological observations.

KOZLOFF MAKING ASTRONOMICAL OBSERVATIONS WHILE WINTERING IN KAM, EAST TIBET.

The spring was, however, slow in coming. The neighbourhood of Barun-tsasak was very dreary, and only in the valleys of the northern slope of the gigantic range of Burkhan-Budda some signs of reviving nature could be detected by the end of April. Kaznakoff was perhaps the most successful in making his collections.

On May 17 (30th N.S.), 1900, we at last left this depôt, and, carrying our baggage on yaks and hainyks, we began our journey by crossing the Burkhan-Budda range along the Nomokhun-gol river. This was done

successfully, and in June, after having slowly crossed the two great ranges of Burkhan-Budda and Amnen-kor, we reached the shores of Lake Russian, pitching our camp at the place where the Hoang-ho flows out of this lake. As we were crossing the Amnen-kor I obtained several specimens of the very pretty Fringilline bird, *Leocosticte roborowskii*, which was described by Prjevalsky, who possessed, however, but one single specimen. Two days after we had reached the lakes of the upper Hoang-Ho, we saw coming large parties of the N'Golok robbers, who were returning from Lhasa with their prince, Hombu-rinchim-shiam. I tried to enter into relations with them, but this was of no use, because their prince, although he had given a solemn pledge at Lhasa never to fight more, said quite frankly that he could not answer for his men, who were sure to attack the expedition as soon as it appeared on their territory. As I did not want, on my very first entry into Tibet, to make use of arms for the conquest of scientific discoveries, I preferred to change my direction and to go straight southward, so as to cross the territory of the N'Goloks on my return journey only.

After having explored with Kaznakoff the northern shores of the lakes of the upper Hang-Ho,* we went along the isthmus which separates Lake Russian from Lake Expedition (Orin-Nor and Jarin-nor; also Hohara-mtso and Hnora-mtso), and crossing the river which connects both lakes, we entered the valley of the river Jaghyn-gol. In order to cross the great watershed between the Yellow and Blue rivers, we followed the course of this river, and on the summit of the watershed we found a marshy, open depression in the mountain range, the altitude of this pass reaching 14,700 feet. From this pass we saw to the north of us the high plateau of Tibet stretching north and west in a succession of gigantic waves, and to the south of us we had the deep gorges and the sharp snow-clad peaks of the Gatu-ju group of mountains.

The plateau of Tibet, upon which lie the sources of the mighty Yellow and Blue rivers and the Mekong, covers with its massive structure an immense area. In its eastern portion, to the east of a diagonal line which runs south-west to north-east, it falls under the influence of the monsoons from the Indian ocean, and is consequently rich in atmospheric precipitation, which feeds these rivers; but to the west of this line, where the plateau attains a still greater height and has a still more even surface, the dryness of the climate progressively increases, and, instead of a covering of grass, we find only a gravelly desert, which was so truly described by M. V. Pyevtsoff as "dead land." In proportion as one moves further east from this diagonal climatic line, and the rivers which flow this way become mightier and

* Ladyghin made soundings in Lake Russian for several miles from the outflow of the Hoang-Ho; they gave depths up to 15 fathoms.

mightier streams, the plateau appears more and more eroded, and assumes the features of an Alpine region.

Deep river-valleys and narrow gorges alternate with the high crests of the water-divides. The roads, or the footpaths, as the case may be, either descend to a great depth or climb to a great relative and absolute height. Here a mild, and there a rough climate; belts of luxurious alternate with belts of an extremely poor vegetation; spots occupied by man, and lifeless summits of the grand mountain ranges—all these alternate in rapid succession before the eyes of the traveller. Most beautiful panoramas of mountains unfold at his feet as he gazes towards the remote horizon, and soon after everything disappears as he stands between the narrow sides of the rocky gorges, where he hears the roaring of the blue and foaming waters, while on the high levels only the howling of the storm fills the air.

As soon as we entered the basin of the Blue river we felt the surroundings to be of a milder character. The roughness of the climate which we had experienced heretofore had been left behind on the last mountain pass. With every step down the gorge it became warmer and drier; the eye rested upon pleasant landscapes. Our herbarium and our entomological collections rapidly increased, as we saw everywhere carpets of flowers, with butterflies, and all sorts of insects fluttering about. Only, owing to the presence of man, we did not see any more representatives of the great mammals which we used to find in such numbers on the plateau.

We soon entered into friendly relations with the first Tibetans, of the Hoshun of Namtso, whom we met, and this friendly intercourse helped us in our further journey southwards. With the aid of the old prince, Namtso-Purzek, and his sons, we found no difficulty in crossing the Blue river, and, going next over a high mountain range, we reached on its other slope the I-chu, a tributary of the right bank of the Yang-tse-kiang. Continuing our journey up this tributary, we reached at the beginning of August the shores of Lake Rhombo-mtso, round which are the settlements of Tibetans from the Dett Hoshun. The elder of these, as dirty as his companions, made his appearance at our bivouac fire, quite frightened. With trembling hands he brought me some presents, and had difficulty in pronouncing his greetings on account of the shaking of his voice. It soon appeared that the cause of this fright was that the Tibetans were saying among themselves that Russians have come at last to revenge the death of their murdered comrade, by whom they meant the well-known French traveller, Dutreuil de Rhins, who perished here from the hands of the Tanguts of the Dett Hoshun.

The expedition soon reached the monastery of Jarku, which was also visited during our stay there by the embassy from the Governor of Sinin, which visits this country once every three years to collect

the tribute. It is interesting to note that our stay in this monastery was precisely at the time when the Boxer uprising broke out in China, but neither ourselves nor the Chinese authorities knew anything about it. We spent our time in mutual invitations to dinners and to fishing-parties in the river, on the shores of which we had our encampment.

After having bade good-bye to the Chinese, who gave us for a few days an interpreter of the Tangut language, we left Ja-chu on August 21 (Sept. 3), 1900, and continued our journey up the river Bar-chu, which brought us to a broad wide valley, closed in the south by a mighty mountain range covered here and there with perpetual snow. This was the watershed between the Blue river and the Mekong. This yet unnamed range of mountains stretches as an immense wall from the north-west to the south-east, and is covered with excellent pasture grounds, visited by the numerous herds of cattle of the nomads. The pass Gur-la reaches 15,200 feet of absolute height, and when we were on its southern slope we were already in the basin of the Mekong. For several days in succession we continued our journey south-westwards, crossing several parallel chains of mountains and numbers of large and small rivers which were carrying their waters to the south-east amidst an imposing labyrinth of mountains. We crossed first the Je-chu, and next the Ja-chu rivers, which together with the Nomu-chu (a river which flows further south and takes its origin near Lake Tengri, in the north of Lhasa, where it is known under the name of Nak-chu) form the river Mekong. We stopped near the frontiers of the district of Lhasa, on one of the tributaries of the Nomo-chu, the Bar-chu.

It must be remarked here that the Ja-chu is considered as the chief branch of the Mekong, and in all probability its sources are situated much further in the interior than has been shown up to the present time on our maps. Another mistake of our maps was also discovered; it concerns the river Nak-chu, which is represented as one of the sources of the Salwen, while in reality the Nak-chu, which is known to the natives by the name of Ji-chu, and after its confluence with the Bar-chu as the Nomo-chu, is one of the chief tributaries of the upper Mekong. As to the upper Salwen, it represents, according to what I was told by the natives, an insignificant river, easily forded, the sources of which lie in the mountains, not far from the high-road to Lhasa.

From our encampment on the Bar-chu I applied to the local authorities for permission to enter the territory of Lhasa, and in expectation of the reply we stayed on the banks of this river for nearly a fortnight, completing in the mean time very successfully our collections of plants, birds, and animals. Finally we received the reply, which was negative; the authorities did not want to let us enter their territory. After having discussed our situation, I decided to change the direction

of our journey, and to proceed south-eastwards to Chamdo, or Tsamdo (a monastery situated at the confluence of the Nomo-chu with the Ja-chu), where I expected to discuss with the Chinese our chances for a further movement southwards, as also the question whether the Tibetans had the right to stop our movements in the Kam region (Eastern Tibet) when we had permission from the Tsung-li-yamen. I hoped that the higher Chinese and Tibetan authorities, whom we should find at Tsamdo, would help us in this respect. So we con-

A MONGOL OF TSAIDAM WHO WENT WITH THE EXPEDITION.

tinued our journey down the Bar-chu, and below its confluence with the Ji-chu we entered the dominions of the Se-chuan authorities. However, at the very first bridge—by means of which the road passes from the left bank of the river to the right, that is, into the dominions of Lhasa—we found a numerous military detachment of Tibetans, who declared that they were ordered not to let Europeans pass. Having no intention to fight, I continued my journey on the left bank, although the road on this bank was not so good as on the

other. I do not know how the Tibetans interpreted this second concession of ours, but I suppose they saw in it a proof of our weakness, and consequently next day, October 28 (November 10), we met on the road to Tsamdo another detachment, much more numerous than the former, and quite ready to begin fighting operations, as they were telling us that they came to drive us away, like dogs, with the fire of their rifles. There was nothing to be done but to accept the fight, and after a sharp engagement the Tibetans were thrown back and dispersed. The road was open. However, the Lhasa authorities immediately sent to us their representatives, who implored us not to enter the monastery of Tsamdo, which is one of the great sanctuaries of Tibet, the fourth in rank. I yielded to their representations. Instead of going south-east to Tsamdo, I turned east, with the intention of reaching the shores of the Blue river at its affluence with the Se-chu, at the monastery of Derghe-gonchen. The plan of exploring Tibet was thus abandoned, and after having covered some 50 miles in an eastward direction, the expedition stopped to winter in the warm wooded valley of one of the tributaries of the upper Mekong, the Ra-chu.

In the basin of the upper Mekong the plateau was still more eroded than it was further north. The expedition found here large forests of fir, and of a tree-like *Juniperus Pseudo-Sabina*, intermingled with birches, willows, wild apricots, wild apples, and a great variety of bushes. The rugged crags, covered with a rich vegetation of trees, bushes, and grasses, presented a beautiful harmony of colours. In the thickly tree-clad gorges we found quantities of the white-eared pheasants (*Crossoptilon thibetanum*), the green *Ithaginis geoffroyi*, the *Tetraophasis obscurus*, the *Tetrastes sewertzowi*, several species of woodpeckers, and a great quantity of smaller Passerine birds. During warm and bright days the naturalist, and in fact every person not insensible to the beauties of nature, could reap enjoyment both with eyes and ears. Flocks of pheasants walked about the little meadows, the eagles described their curves on the blue sky, and from the thickest of bushes, richly coloured by sun's rays, the songs of thousands of small birds could be heard. Of mammals which we did not see previously, we found monkeys, which were living in large and small colonies—very often in close neighbourhood to the Tibetans. Our hunting excursions after these interesting animals were successful, and enabled us to complete our collection with beautiful specimens of both males and females.

While wintering in this beautiful corner, we carried on our usual work. We made meteorological observations at a small meteorological station which we had established here, as also on the slope of the mountain, by the side of a small house where I was making astronomical observations. My men spent their time in hunting and in

collecting seeds of the wild grasses and berries, as also all sorts of materials concerning the history and ethnography of the Tibetans. My comrade Kaznakoff, together with Ladyghin, also undertook excursions up the Ja-chu, and eastwards, as far as the monastery Derghe-gonchen. This last journey was accomplished very successfully in a short time, although my comrade had to pass localities the population of which was anything but sympathetic to us. I must also say a few words about the men with whom we so often stood at times in friendly and at times in hostile relations.

The population of this region is divided into the settled, *Iba*, and the nomad, *Bok-pa*. The former have their houses and farms in the valleys and gorges, where the warm climate permits them to grow

BEGGARS IN KAM.

cereals up to an altitude of 12,000 feet. The others pitch their black tents in the region of the alpine meadows, the upper limits of which lie some 3500 feet higher than the upper limits of the agricultural zone. About these nomads I will not speak, because they have been well depicted already by Prjevalsky. As to the settled population, their mode of living is much better than that of the nomads. They make their houses of thin logs, or of wickerwork, which is covered with a thick layer of clay. These houses usually have two and three storeys. The lower one is used for the cattle, while the second and third are used either by the inhabitants themselves or for storing their grain, their straw, and their hay, and also the domestic utensils. The threshing-ground is usually made on the roof of the first storey, and the corn is threshed by means of a flail similar to ours.

The dress of both men and women consists in the winter of a sheepskin, and in the summer of a sort of woollen dressing-gown. The latter, however, is only worn by the richer folk. The skirt of the sheepskin is usually tacked high so as to make round the body a sort of sack, into which the Tibetan puts his cup, his oil, his tobacco, and so on. Of course, the sack is filled with all sorts of things on a journey. Then above the sheepskin, which I must say is usually worn without any underclothing, is worn a broad felt mantle. Trousers are seldom worn by men, and are quite unknown to women. As to the head-dress, it consists of a felt hat, or of a red scarf, which is wound around the head like a turban. The women decorate their heads with a string of big pieces of amber, similar pieces, as well as shells and discs of silver and white copper, being attached also to the dresses. The dirty hands of both men and women are covered with silver rings and bracelets, and in one ear they wear large-sized earrings. Their boots are made of woollen cloth of different colours. As the Tibetans never wash themselves, and always live in great dirt, almost never taking off their sheepskins, they diffuse an abominable odour.

They practise polyandry, several brothers often taking one wife. It also happens that after the death of his first wife, the father will marry the same woman to whom his elder sons are married. It seldom happens that a rich Tibetan has two wives. Good-looking women are very rare, and then only among the younger ones.

The winter in this locality is extremely mild. There is rarely snow, and the atmosphere remains transparent and dry. There is usually no wind at night or in the morning, but it systematically began to blow every day after midday from west-south-west. We had bright weather at the end of November and during all the month of December. January was rather cloudy, but in February the cloudiness began again to diminish. The lowest temperature which we observed was during the night of January 5–6 (18–19), when the thermometer fell to $-26\frac{1}{2}°$ Centigrade. In December, at one o'clock, the mercury fell below the freezing-point only four times. The same was also in January, the lowest temperature at 1 p.m. being $-4{\cdot}8°$ C., which temperature we had after the above-mentioned low minimum during the night.

There was no ice at all on the river Ra-chu, but its tributaries, small streamlets, were quite solidified by the ice, although at midday in the sun's rays ice was thawing even during the coldest part of the year. Snow fell very seldom, and thawed as it fell or disappeared next day. In short, the southern slopes of the mountains were always free from snow, and only thin layers of it appeared on the northern slopes, as well as in the higher parts of the mountains. After each snowfall, the atmosphere, which was always very clear, became

still clearer, and the sky assumed a deep blue colour, especially before sunset.

In February the temperature began rapidly to rise, the mountain streamlets began to roar, the birds began to mate, the eagles began to rise to tremendous heights and send forth their love-calls—in short, winter was over. I now decided to move eastwards, and to pass through the districts of Derghe-gonchen and Khor, and, after having explored them, to move up the Ya-lun-tsian, and then to the lakes of the upper Hoang-Ho, and next to Tsaidam.

Leaving the warm valley of the Ra-chu, we had once more to cross the cold plateau, as also the water-dividing range between the Mekong and the Blue river, of which the pass reached 16,000 feet, and was covered with snow.* Here, on the banks of the Blue river, which flows at an altitude of about 10,500 feet above sea-level, it was also very warm, and we saw already the first appearance of spring vegetation; the *Gentiana squarrosa* was in bloom, as also the buttercups, the dandelions, and so on. All sorts of insects and butterflies flew about. We also noticed the bank swallow (*Cotile riparia*). The Tibetans were busy in tilling the soil, and some of them had already begun sowing wheat and barley, while on the best fields we saw the first seedlings of wheat piercing the ground.

We stayed but a few days near the monastery, and resumed our journey by crossing the high chain of mountains which separates the Blue river from its left-bank tributary, the Ya-lun-tsian. We spent Easter—the last Easter during this hard but most interesting journey—at the village of Bana-jun, near the valley of the Ya-lun. We explored next the district of Khor, so far as it was possible on account of the time and the hostile attitude of the population, and I finally decided to resume our return journey. We consequently went up the Ya-lun-tsian, following its left bank, but were compelled to move rather slowly, because its banks were occasionally so steep as to compel us to go more inland. Still we progressed, and we soon had left behind

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* This part of the journey of Kozloff is extremely interesting. On his way to the Blue river, he was compelled to cross once more the nameless range of mountains which separates the Mekong from the Blue river, and by this second crossing he determined the exact position of this important orographic feature. From the accompanying map, it will be seen that there are at least three different ranges of mountains which cross this part of the Tibetan plateau in a direction from the north-west to south-east. We may thus say that in all probability, instead of the fanlike ranges of mountains which we see on our present maps, radiating between the Mekong and the Blue river and their tributaries, under the 27th and 28th degrees of latitude, we have the same plateau, with ranges running in the same north-west to south-east direction, and very probably it will be easy to connect the Himalaya escarpment of the high plateau of East Asia with the Khingan escarpment of the lower terraces of the same plateau.—P. A. Kr.

the zone of cereal culture, and entered the regions occupied by nomads only.

Owing to close intercourse with the robber bands of the N'Goloks, the local nomads, Ja-chu-ka-va, have become as bad as their neighbours. Especially one of their *hoshuns*, Lin-gu-ze, which does not recognize its submission to the Chinese, and also does not recognize the supremacy of the N'Goloks, is renowned for its wild robber instincts. With these robbers we had a serious conflict. Happily enough, our guides and carriers from the *hoshun* of Dunza, who are as much robbers as the former, seeing that we were always ready to repulse an attack, found it more profitable to bring us peacefully across their territory, but they warned us that we should be attacked in the *hoshun* of Lin-gu-ze. Their prediction was fulfilled. On the morning of April 25, on one of the numerous mountain passes of the basin of the Ya-lun-tsian (or, as it is named by the Tibetans, the Ja-chu), namely, the pass Bi-mu-la, the Lin people numbering several hundred men and occupying several mountain summits attacked us. As soon as our vanguard, which consisted of Kaznakoff, myself, and the Cossack Badmajapoff, appeared on this ground, they opened a sharp cross-fire from their matchlock guns. We had already noticed them for some time since, and consequently had settled our plan of action.

From time to time we advanced slowly forward, sitting down for awhile and shooting at the robbers. It must be remarked that we had to fight at an altitude of 15,000 feet above sea-level, where the rarefied air rendered us uncomfortable, notwithstanding our experience of such altitudes. As our caravan approached the summit of the pass, and as more men from it came to reinforce us in the vanguard, the shooting of the robbers became slower, and after an hour's time we had reached the head of the pass and cleared it entirely. The robbers were running away southward, to the Ya-lun-tsian. We quietly took our breakfast at the top of the pass, where we found considerable quantities of ice and fuel, prepared by the robbers while they lie in ambush, and then we began to descend on the other side of the pass, sending out our scouts in different directions. At a spot where the main gorge meets a side gorge coming from the left, the robbers, having received reinforcements of another hundred men, had taken their position with the intention of attacking us at the same time from two sides. Besides, part of them were standing upon the rocks on the sides of the narrow gorge ready to roll big stones down the mountain, so as to produce a panic in our caravan. Happily enough, this ambush was discovered in time by our scouts. So I sent six of our men to drive away the Tanguts, and myself continued to move slowly down the main gorge. The robbers did not expect an attack, and after a few shots from our scouts ran away, meeting, instead

of us, their own comrades, who had been taken by panic and were in full flight. Our main body did not pursue them, because just at this moment came several lamas to offer to conclude an armistice. After having settled the general conditions, I ordered one of the lamas immediately to gallop full speed after the runaways, and to order them never to appear more with their arms in the way of our expedition. This promise was strictly kept, and so we passed without any difficulty, although the robbers had intended to lay for us a third ambush.

After that, our expedition continued its journey without any other difficulty. Moving slowly north-westwards, towards Lake Russian,

SMALL TOWN, KUAN-GO-CHEN, IN THE HAN-SU PROVINCE, NEVER BEFORE VISITED BY A EUROPEAN.

we soon met a few natives, Ja-chu-ka-va, who knew the upper course of the Yellow river, and a few days later we met an old Tangut who knew Lake Russian, and who undertook for a good remuneration to be our guide. Guided by this old man and his three younger comrades, we crossed the most interesting localities of the basin of the Yellow and the Blue rivers; and on May 30 (June 12, N.S.), from the top of a pass, we made out the blue shining surface of Lake Russian. Nearly a year before we had left it from its western extremity. Now we had under our feet its south-eastern shore. In one or two hours' time we had reached it, and had our bivouac close by its waters. An excellent road runs along the eastern coast of the Orin-nor, and after a two days' march we reached our old encampment at the issue of the Hoang-ho

from the lake. Here I concluded the survey which I had made throughout our journey in Tibet.

The remainder of our journey to Tsaidam I shall not describe, because we went along a well-known road. Our comrade, Ivanoff, who had been left in charge of the meteorological station, met us in the valley of the Alyk-norin-gol. I had sent him notice by one of the Tsaidam Mongols, asking him to meet us on our journey, and to bring the letters which might have been received from Russia. We were delighted to find that everything in Tsaidam was in excellent condition. The very same day as we came thither we met also a Chinese interpreter, who had been sent by the Governor of Sinin to meet the expedition, and to bring it a bulky mail from Russia.

After having stayed during the hot season in Eastern Tsaidam in the mountains, we resumed our return journey on August 1 (14), and four months later reached the frontiers of our fatherland. Even this stay in Tsaidam was not lost, because we made frequent excursions in the mountains and completed our collections; but during one of these excursions we nearly lost one of our young men, Madaeff, at whom Tangut robbers had fired from an ambush. While I remained at the meteorological station, making astronomical observations, and bringing everything in order for the future journey, Ladyghin made an excursion for the exploration of the lakes Taso-nor and Kuzlyk-nor in Northern Tsaidam.

I will complete this short report on the work of the expedition by the following letter which I had sent from the extremity of the Eastern Altai to the Russian Geographical Society:—

"As you know already from my previous report, the expedition left Tsaidam at the beginning of August. The weather continued, however, to be hot, and, owing to heat, as also the horse-flies and the mosquitoes, we lost fifteen of our best camels, out of our herd of fifty head, so that we had to buy camels on the way from the natives. I made, with Ladyghin and two Cossacks, a side excursion to Sinin, while the main body of the caravan, under A. N. Kaznakoff, went along the straight route to the Cheibsen monastery. I considered it my duty to personally thank the Tsin-tsai-yu for all he had done to facilitate our sojourn in the Kam region. From our conversations with him, we learned that there was great anxiety in Russia about our expedition. 'I have received three telegrams from Pekin about you,' he said, 'each one even more anxious than the former; but I knew myself nothing about you.' . . . The good functionary took great interest in the Kam region and its inhabitants, and advised me not to go so far another time, and to avoid regions peopled with robbers. As to the Governor (Dao-tai) of Sinin, who had spent a long time in the Ili region, and knew there the late V. M. Uspensky, he, on the contrary, took great interest in knowing how much of the region remained unmapped, whether we had made good collections, and so on.

"From Cheibsen we travelled along the same old route, of which I now made a survey. Continual rains which we experienced in the province of Han-su did not permit us to make many excursions in the mountains, which are so rich in vegetable and animal life. Our thoughts were also chiefly directed towards preserving the treasures which we had accumulated in Tibet, and we were quite happy to find that everything we had left with the lamas at the Chorten-tan monastery was in perfect order, and that the lamas welcomed us back so cordially.

ONE OF THE GORGES OF THE UPPER MEKONG.

"We did not stay long at Chorten-tan, as we were in a hurry to cross the Gobi before the beginning of the great colds (the frosts already reached $-20°$ C.). After having crossed the Chagryn steppe, we came to one of the most miserable Chinese towns, Kuang-go-chen, which had never been visited before by Europeans, but the authorities of which had already been warned of our arrival by the amiable Tsin-tai of Sinin. These authorities, as well as the Van of Alashan, helped us in crossing the Gobi. In short, on this return journey, as well as on our out journey, we met with no difficulties. We even chose this time a

new direction, and thus made a fourth traverse of the Gobi, between the eastern route which Prjevalsky had followed so many times and the route I had followed two years ago in the western portion of the desert. Here also, in proportion as we moved north, we saw that the country lost its character of a plain, and was intersected with ranges of hills and hillocks. We also considerably increased our geological collections, as, being on our way home, we could better follow the instructions which had been given to us by V. A. Obrucheff.

"Soon after we had left the residence of the Alashan prince, we were overtaken by a Tarancha from Jarkent, who had been sent by the Russian consul at Urumchi in search of our expedition; and it was only then that I understood the anxious telegrams of which I had been told at Sinin. We also learnt that here, too, in Mongolia, a Mongol and a Russian were vainly trying to get news from the expedition. We, too, were extremely anxious to get some news from home."

On November 22, 1901 (December 5), we were at last at Kiakhta, and in January following I was at St. Petersburg.

In conclusion, I will permit myself to enumerate the main results of the expedition. We have thoroughly explored the Chinese or Mongolian Altai, the Central Gobi, and that portion of Inner Tibet which is known as "Kam." The Altai has been explored all along its northern and southern foot, and has been crossed several times. The desert of the Gobi was crossed along four different routes in the winter —provisions of ice or snow being taken during these crossings. In Eastern Tsaidam, at the northern foot of Tibet, a depôt of the collections and the provisions was organized, and the camels were left, the journey in Tibet being only possible with oxen. At this depôt a meteorological station was organized, as had been recommended by the late General Tillo. Four men, under Sergeant Ivanoff, were left at the station, and the conduct of the meteorological observations was left to Muravioff, who had received the necessary preliminary training. The Tsaidam meteorological station has thus worked for fifteen months without interruption, the records of the instruments being taken thrice a day, and once every three months every hour for twenty-four hours in succession. This was the first time that such work was done in Central Asia, and the observations of the Tsaidam station will give a solid basis for calculating our altitudes in Tibet. It was also the first time that a canvas boat was used for the exploration of lakes in Central Asia—their depths and their flora and fauna.

We also used during this expedition, more frequently than before, the system of sending out separate excursions, which were made by my comrades Kaznakoff and Ladyghin, while I journeyed with the main body of the caravan. Owing to this system, we were enabled considerably to increase the domain of our exploration, as also the value of our collections.

We brought back with us—(1) about 8000 miles of survey; (2) the positions of forty localities determined astronomically; (3) geographical, historical, and ethnographical, as also commercial information about the regions visited; (4) more than 400 photographs; (5) meteorological observations which were made regularly every day; (6) and rich natural history collections—that is, about 1200 geological specimens; nearly 1400 species of plants (over 30,000 specimens); and the following zoological specimens: 300 skins of mammals, 10 skeletons, 1500 birds, 500 fishes and reptiles, and 30,000 insects. All these collections have already reached St. Petersburg in good order, have been arranged, and are already in the hands of specialists and different scientific bodies.

TRAVEL AND TRADE ROUTES IN NORTH-EASTERN RHODESIA AND ADJACENT PARTS OF EAST CENTRAL AFRICA.

Our knowledge of the geography of North-Eastern Rhodesia has received considerable additions within the past few years from the journeys of members of the administration, who, in the course of their official duties, have had occasion to travel by new routes through some of the less-known parts of the territory. Through the courtesy of Mr. Robert Codrington we are enabled to give accounts of two such journeys through the region lying between the Loangwa and the Kafue, while Mr. Codrington himself sends us the account of a recent voyage on Lake Tanganyika, with instructive remarks on the present state and prospects of European enterprise on the lake and in neighbouring regions. Much activity has also been displayed by the French missionaries known as the "Pères Blancs d'Alger," who within the past three years have established themselves in the Awemba country, and have in some cases made good use of the opportunities afforded them of adding to our knowledge of the country. Some of the results of their journeys have kindly been placed at our disposal, and of these we hope shortly to give a summary. In the present number we confine ourselves to the work of British officials.

I. A VOYAGE ON LAKE TANGANYIKA.

By ROBERT CODRINGTON.

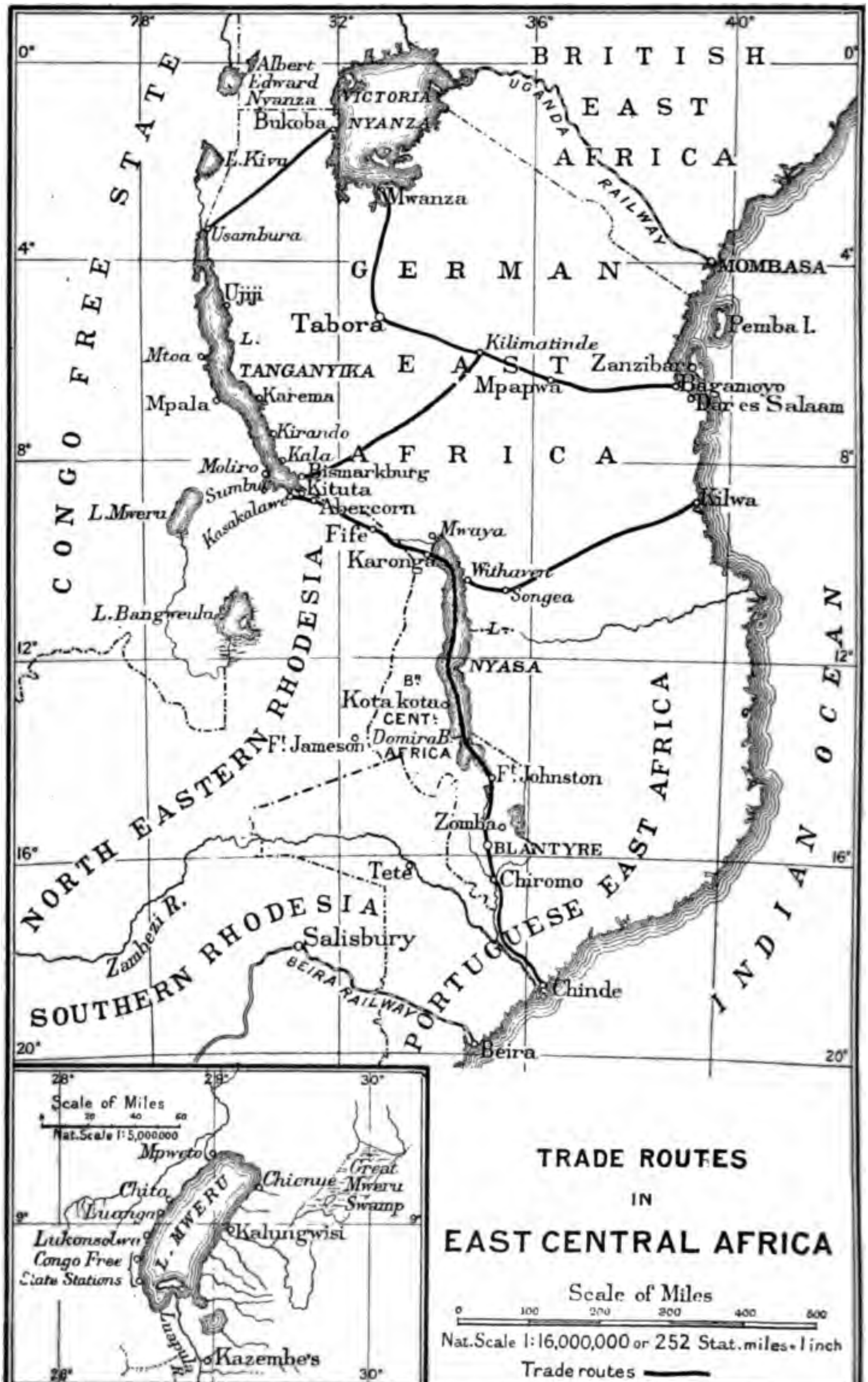
In June, 1901, Mr. Codrington embarked at Kituta on the German Government steamer *Hedwig von Wissmann* (*Journal*, vol. xvii. p. 430), which, like her sister-ship on Lake Nyasa, earns money by carriage of freight and passengers, besides being available for Government purposes. She carries a 4-centimetre quick-firing Krupp gun, and has a speed of 8 to 10 knots and a cargo capacity of thirty to forty tons. The first point touched at was the German military port of Bismarckburg—the headquarters of the "bezirk" of Ukonongo. There are eighteen European residents and a native garrison of ten Sudanese and a hundred locally

enlisted troops, while some fine buildings are in course of erection. The harbour, however, is not good, but a little further up the coast is the large land-locked, harbour which has been named Wissmannhaven. Kala, the southernmost of the mission stations of the Pères Blancs d'Alger on Tanganyika, is next reached. Both here and at Kirando, situated in an exceptionally fine bay reached by four hours' steaming from Kala, good and substantial buildings have been erected. The church at Kirando is large and contains beautiful wood-carving. At Utinta, reached on June 5, there is a good harbour, and as the telegraph-line passes 10 miles inland, a depôt for the reception of material has been formed in the bay. There is also a station of the Pères Blancs. The most important mission station on the east coast of Tanganyika is at Karema, which is the residence of the bishop. It has no harbour, however, and is often inaccessible, especially during a south wind.

Ujiji was reached on June 7, after nineteen hours' steaming from Karema. The native town, with its ten thousand inhabitants, covers an enormous area, well shaded by mango trees, bananas, and palms; but most of the houses are mere hovels, and the whole place reeks with dirt and disease. The principal Arab, Sefi bin Rashid, who has been appointed Wali by the Government, lives in a good double-storied house, and entertained his visitors with champagne and coffee. There are about sixty Arabs and thirty Banyans (British subjects), while the Europeans number eight, including two Greeks who have a large store. The fort is well placed and substantially built, but the garrison is very small, the troops of the "bezirk" being distributed over a large area. There is no harbour at Ujiji, and steamers usually anchor in Kajoma bay, some 7 miles north, whither the Government station will probably be transferred shortly. The survey of the Transcontinental Telegraph is already completed to Ujiji, which will be connected with the main line by a branch of 13 miles, and is being extended to Kajoma. Every assistance has been given by the German officials on Tanganyika, and it is confidently expected that the line will be open to Ujiji during 1902.

From Ujiji the voyage was continued to Usambura, 6 miles from the mouth of the Rusizi, a German station with a white population of seven, communicating in two days with the important post on Lake Kivu. It seems a foregone conclusion that the labours of the commission now at work will result in the selection of the Rusizi river as the boundary between Germany and Congo State territory in this region. At the time of Mr. Codrington's visit an expedition was despatched against the Congo rebels, who were causing trouble in German territory. They are well armed and bold, and neither the Belgians nor Germans have a sufficient force to deal decisively with them, though the Germans have recently disarmed over a thousand of them, whom they have supplied with seed-corn and settled down in the Ujiji district. On the German coast of Tanganyika troubles with the natives seem rather due to their failure to pay taxes than to actual hostility towards Europeans, and the telegraph surveyors have never been hindered or molested by them.

On June 12 the lake was crossed to the Congo Free State station of Uvira, where there is a garrison of three officers and three hundred native soldiers. A further passage of twenty-three hours brought the steamer to Mtoa (Towa), or Albertville, the principal Congo State station on the lake. Mpala was reached hence by nine hours' steaming, and St. Louis, the port for Baudoinville, by another two. Mpala and Baudoinville are stations of the Pères Blancs, the latter being the residence of the bishop, who is Vicaire Apostolique du Haut Congo. Twenty-six missionaries, including eight sisters, are distributed between the two stations, and the churches are very large and magnificent. Mvua and Moliro, the latter just


TRADE ROUTES
IN
EAST CENTRAL AFRICA
Scale of Miles
Nat. Scale 1:16,000,000 or 252 Stat. miles = 1 inch
Trade routes
BRITISH EAST AFRICA
GERMAN EAST AFRICA
CONGO FREE STATE
NORTH EASTERN RHODESIA
SOUTHERN RHODESIA
PORTUGUESE EAST AFRICA
INDIAN OCEAN
UGANDA RAILWAY
BEIRA RAILWAY
Albert Edward Nyanza
VICTORIA NYANZA
Bukoba
L. Kivu
Usambura
Mwanza
MOMBASA
Pemba I.
Ujiji
Tabora
L. TANGANYIKA
Kilimatinde
Mpapwa
Zanzibar
Bagamoyo
Dar es Salaam
Mtoa
Mpala
Karema
Kirando
Kala
Moliro
Bismarkburg
Sumbu
Kituta
Kasakalawe
Abercorn
L. Mweru
Fife
Mwaya
Kilwa
Karonga
Songea
L. Bangweulu
L. NYASA
Kota kota
Bᵀ CENTᴸ AFRICA
Ft. Jameson
Domira B.
Ft. Johnston
Zomba
BLANTYRE
Tete
Chiromo
Zambezi R.
Salisbury
Chinde
Beira
Scale of Miles
Nat. Scale 1:5,000,000
Mpweto
Chienue
Great Mweru Swamp
Chita
Luanga
L. MWERU
Kalungwisi
Lukonsolwa
Congo Free State Stations
Luapula R.
Kazembe's

within the Congo State boundary, are miserable places; but Sumbu, the British port on Cameron bay, is a well-built station, second to none on the lake. Through it passes most of the trade for Lake Mweru, around which lake there are now living some forty-five Europeans. A small township has been laid out at Sumbu, and another is springing up at Kasakalawe, considered to be the best port at the south end of the lake. It has been adopted by both the Tanganyika Concessions Company and the African International Flotilla and Transport Company, and is pleasantly situated, sheltered by forest trees from the heat and glare of the beach. The anchorage is satisfactory, and in case of a strong wind from the north, perfect shelter is available opposite at Niamkolo.

The vessels now plying on Tanganyika are—the "Tanganyika Concessions" steamer *Cecil Rhodes* (twin screw), with a carrying capacity of from thirty to forty tons; the German *Hedwig von Wissmann*, with about an equal capacity; the African Lakes Corporation's steamer *Good News*, with a carrying capacity of twenty tons; the Katanga Company's steamer, with a carrying capacity of from thirty to forty tons; and the Congo Free State schooner, carrying about one hundred tons. Some five or six dhows, the property of Arab and Greek traders, compete in a small way with the European-built vessels. The lake, though said to be more stormy than Nyasa, is considered a safe waterway by the skippers of the vessels, no dangerous rocks being reported. The level of the lake in June, 1901, was 4 or 5 feet higher than in the corresponding month of 1900, the Lukuga outlet having again silted up.

The German firms at Bagamoyo and Dar-es-Salaam have withdrawn their European agents from Tanganyika, owing to losses through giving credit to Arabs and natives; and what small trade there is on the German coast is in the hands of the Greeks, Arabs, and Banyans. The Banyans buy their goods in India, and transport them cheaply by means of dhows to the African coast, so that they are able to compete with the Greeks and Arabs, who buy in a dearer market at Bagamoyo. Minerals have not yet been proved to exist in the German territory, and rubber has been worked out in the neighbourhood of the lake, though abundant and untouched in large areas inland. Coffee and wheat, palm oil, and salt are at present produced for local consumption only, but the salt may become more largely marketable. The enormous labour-supply should render the development of the German sphere somewhat easier than that of the British sphere adjoining, but the unreasonably high rate of pay fixed by the German Government is unfortunately calculated to strangle any young industry. At Bismarckburg the rate is 8 rupees a month—more than double the rate in the British sphere.

There is no trade, properly so called, on the Congo coast of Tanganyika, but all rubber and ivory is regarded as the property of the State, and has to be surrendered by the natives in fixed quantities annually. The natives are, however, continually in rebellion, and the country is unsafe except in the immediate vicinity of the military garrisons, and within the sphere of influence of the missionaries.

Of the three trading firms established on the British coast, the African Lakes Corporation alone transacts any considerable business, its well-organized and equipped transport route from Chinde to Tanganyika placing it in a favourable position to secure nearly the whole trade of the Tanganyika and Mweru regions. On the shores of the latter several small European posts are springing up. The Katanga Company ("Comité spécial de Katanga") has several stations on the Congo side, and at the four posts of Mpweto, Lukonsolwa, and the two opposite Kilwa island, there is a total of about twenty-eight Europeans. At Luanga Mission station there are about seven, and some eight or ten are distributed along the navigable portion of the Luapula. Fort Rosebery or Johnston Falls is the head-

quarters of the Native Commissioner of the Luapula Division. On the British side of Mweru are Kalungwizi, the residence of the district magistrate, and Chienji, the station of the African Lakes Corporation, where the African Transcontinental and Flotilla Company is also established. The Europeans on this coast number nine or ten.

The greater part of the rubber reported from North-Eastern Rhodesia in recent years has been obtained from the Congo side of Lake Mweru, and it is to prevent this that the Katanga Company has established its posts on the lake-shore, and built a steam-launch to patrol the lake and the Luapula. The African Lakes Corporation have also a small steam-launch, and there are three or four steel sailing-boats on the lake.

Much has been done by the Germans to open up overland routes to Tanganyika, by which supplies are now transported to Ujiji and Bismarckburg to the entire neglect of the Shire-Nyasa route. From Kilimatinde and Tabora, on the trunk road from Dar-es-Salaam to the Victoria Nyanza, roads branch out to Bismarckburg and Ujiji respectively, while from Kilwa a road runs through Songea to Withaven on Nyasa and connects by steamer with the road under construction from Mwaya to the British road between Nyasa and Tanganyika. Supplies for German Nyasaland at present go by the Shire route, but the German Government is determined to develop the overland route from Kilwa. With the completion of the Uganda railway to Victoria Nyanza another and perhaps the best route to Tanganyika will be available, there being less than 200 miles overland transport between the two lakes. The German officers on Tanganyika are confident that a railway from the coast to Tabora will be built within the next five years.

Supplies for the Congo State territory are transported both by the Congo and by the Shire route. A caravan from Tanganyika to Boma takes from two and a half to three months, and communication is often interrupted.

The British route to Tanganyika has many natural advantages, the chief being, of course, the Zambezi, Shire, and Nyasa waterways, all of which are provided with ample shipping. The only impediments in this route are comprised in the unsatisfactory overland connection between Nyasa and Tanganyika. The proposed railway between the lower and upper Shire hangs fire so long, that it appears quite possible that the idea will not be realized for many years to come. Meanwhile various improvements are being made on the road, which should shortly be available for continuous waggon-traffic. Native labour is during some months of the year very plentiful, and the transport of goods to the north end of Lake Nyasa presents very little difficulty. The so-called Stephenson road, often shown on maps as stretching from Nyasa to Tanganyika, has never actually existed, the route being simply roughly cleared for some 60 miles from Lake Nyasa. The British South Africa Company have, however, constructed a broad and well-made waggon road from the border of the British Central Africa Protectorate to the shore of Tanganyika, and across this road waggons are continually plying. From Nyasa to the border of the Chartered Company's territory it is quite impossible to make use of vehicles. The road runs up the escarpment of the Nyasa-Tanganyika plateau, ascending nearly 3000 feet in 30 miles, and would cost, probably, from £5000 to £7000 to put in a proper condition for waggon-traffic. The construction of this road is, without doubt, worthy of attention, if the Zambezi-Nyasa route to Tanganyika is to be maintained.

The following table shows cost and duration of transport to Tanganyika by various routes. Although the British route appears at present to be the best, such will not necessarily be the case in future, unless as much energy is exerted to improve it as is being put forth by the Germans on the overland route through German East Africa.

TRADE ROUTES TO TANGANYIKA.

Routes.		German Route.			British Route.		
		Period for mails.	Period for merchandise.	Cost per ton for merchandise.	Period for mails.	Period for merchandise.	Cost per ton for merchandise.
		Days.	Days.	£	Days.	Days.	£
A. Bagamoyo and Dar-es-Salaam *viâ* Tabora and Ujiji		36 to 42	60 to 70	106			
B. Chinde to Karonga	dependent upon connections				21	50	17
Karonga to Kituta					10	18	30
Kituta to Ujiji					6	6	8
					37	74	55
C. Bagamoyo and Dar-es-Salaam *viâ* Kilimatinde to Bismarckburg		30 to 40	70 to 80	106			
D. Kilwa to Wiedhafen (Lake Nyasa)		20 to 30	40 to 50	26 to 30			
Wiedhafen to Bismarckburg ...		15	20	26 to 30			
		35 to 45	60 to 70	52 to 60			
E. Chinde to Karonga	dependent upon connections				21	50	17
Karonga to Kituta					10	18	30
Kituta to Bismarckburg					1	1	2
					32	69	49

II. JOURNEY FROM DOMIRA BAY, LAKE NYASA, TO FIFE, ON THE TANGANYIKA PLATEAU.

By CHARLES McKINNON.

The voyage from Fort Johnston to Domira bay was made on January 22, 1901, by the African Transcontinental Telegraph Company's s.s. *Adventure*, formerly a gunboat, and one of the fastest and best sea-boats on Nyasa. There is a telegraph station at the bay, and a subsidiary line branches off hence to Fort Jameson. The road to the fort runs west, ascending to the Angoniland plateau on the second day and passing the Dutch mission station of Mvera with its coffee and vegetable gardens, and 15 miles further on the British post at Dowa. The elevation of the plateau, which, though it looks poor, supports a large population, is about 5000 feet. Beyond the Bua river a low ridge dividing the British Central Africa Protectorate from the Chartered Company's territory was crossed, Fort Jameson, the seat of government of North-Eastern Rhodesia, being reached on the following day. Here there are a number of good buildings erected both by the administration and by trading companies. The township is laid out in wide streets, and some thousands of shade trees have been planted, with good waggon-roads to the east, west, and south. Hence the journey was continued, with a fresh lot of carriers, in a north-westerly direction, through a sparsely populated country, the large village of Kwambiri, head of the Wabisa of these parts, being reached on the fifth day. The next day the crossing of the Rukusi, in high flood at the time, caused some delay, it being necessary to wait until the water subsided. The Loangwa was crossed in canoes on February 13.

Both banks of the Loangwa for several miles are heavily timbered with mopani forest, which seems peculiar to this valley, as it does not exist further west on any of the large rivers in British territory. The country abounds with game. Nawadia, reached on February 14, is a post of one of the native commissioners for North-Eastern Rhodesia. The house, a massive stone building, is on a kopje overlooking the Nyamadzi river, and is situated on one of the old slave routes to the interior. Two days later, Mpiga, another native commissioner's post, situated in the Awemba country 65 miles north-west of Nawadia, was reached, the Mchinga range having been climbed meanwhile. The range at this point is about 12 miles in width, very well wooded and watered, all the rivers flowing to the Loangwa. From Mpiga a visit was paid to Lujembe, the most southern of the Awembe chiefs, who, as was formerly the general practice, keeps a band composed of blind minstrels. A mission station of the Pères Blancs d'Alger, one of four built since 1899 in the Awemba country, was passed *en route*. Lujembe's is a great centre of the salt trade, as there are extensive pans close by, to which people come from long distances, paying a small tax to the chief for permission to work them. The surrounding country is called Chinama, which in the Awemba language simply means "game," to which the salt is doubtless an attraction.

At Mpiga's the Angoni carriers—who had proved a superior lot of men—were sent back, and other carriers engaged without difficulty. A march of 45 miles north and north-east led to the Karungu river, where is an Administration rest-house and a large native village. Two more days brought the party to the Chambezi, which, where crossed, is narrow with high banks, and is deep and sluggish. Below, rapids occur, obstructing an otherwise important waterway. The river was crossed in canoes, and the march continued in a north-easterly direction along the banks of the Rukuru—one of the largest tributaries—to Kasama, the principal Administration post in the Awemba country. It stands on a high ridge overlooking the Chambezi valley, and round it quite an important little township is springing up, several stores being in course of erection. Not far off is the Likabula station of the Pères Blancs d'Alger, who, during the two years since Europeans were admitted into the country, have shown great energy and enterprise, having already built double-storied brick dwelling-houses and a large church, using for the roofs of the buildings a kind of slate (schist) found in the vicinity. From Kasama the route led across some flooded country to the village of Kitiamkula—nineteenth king of the Awemba—who gave a hearty welcome to the traveller.

The present Kitiamkula's full name is Mkuta Chikuta Mwaswe. He distinctly remembers Livingstone, who visited Chitapangwa, the Kitiamkula of that day, and the seventeenth king, going on from his village to Mwamba's. Chitapangwa's village was situated close to the site of the first Administration post of Kasama. Some six years ago the predecessor of the present chief, Sampa Kitiamkula the eighteenth, died, whereupon Mwamba, his most powerful vassal, tried to make himself king, ejecting by force the high priest, by whom his pretensions were opposed. The latter was, however, supported by Mr. Young, the native commissioner, by whose help he regained possession of the "god," or idol, without which no claim to the priesthood could be valid, and shortly afterwards the present Kitiamkula was made king. Muruli, where the high priest lives, is the burial-ground of all Awemba belonging to the ruling family, the place of sepulture being apparently a shallow pit encircled by a fence of palm trees in a clump of virgin forest. When Mwamba died, the Administration refused to allow the usual human sacrifices to take place, while, by the custom of the tribe, his successor could exercise no authority until the funeral rites had been performed. Matters remained

at a deadlock for two years, after which time the people at length yielded, and quietly buried the remains. The "god"—apparently an idol of some sort—is kept at Mruli in the inner of two houses, one within the other, the outer of which is crammed with antelope-horns. There is another hut at a little distance, in which food is placed daily by the "god's wife," who is the widow of a former king, and who is the only person besides the high priest allowed to enter either of the huts. In fact, none of the Awemba will enter the s'ockade of Muruli unless bidden by the priest.

A day's march from Kitiamkula's, the Chambezi, now in high flood, was crossed by means of one small canoe, and after passing Kayambi, another mission station of the Pères Blancs, the caravan crossed the Chozi, a fair-sized river once supposed to be one with the Chambezi.* Two days lat r Fife was reached, a journey of over 600 miles having been completed in fifty days, at the worst time of the year, without any detriment to health, in spite of the constant wettings experienced.

III. JOURNEY TO THE KAFUE AND ZUMBO DISTRICTS.†

By P. H. SELBY.

The journey was commenced from Fort Jameson on May 11, 1901, the route leading *viâ* Sassare (where a recently discovered gold-reef is being worked with success) to Hargreaves, a station of the North Charterland Exploration Company on the Loangwa. Beyond this river the track rises 2000 feet in the first 21 miles, crossing the Kwessi or Ngoza range before descending into the flat well-watered valley of the Lukashashi and its tributaries. A comparatively sharp ascent of 1500 feet next leads to the south-eastern edge of the Mchinga plateau, over which the route passes through 40 miles of fertile bush country to the Mkushi river station, situated on a healthy site 3738 feet above sea-level. The Mkushi is a clear swift-flowing perennial stream some 20 yards in width. The district is sparsely populated by Walala, a nomadic tribe who have been accustomed to shift their wretched huts every year, but who will probably settle down more permanently now that they are secured from raids by the establishment of a Government station. A narrow road is being hoed from Mkushi to connect with the Fort Jameson-Hargreaves road, and a track has been made to Serenji.

The path from Mkushi to Kapopo station—140 miles further west—crosses, halfway, the watershed between the streams flowing south and south-east to the Lunfsewa, and those flowing north and north-west to the Kafue or Kavu, the district inhabited by the Walamba tribe being then entered. The tributaries of the Kavu flow slowly in beds cut through deep rich black soil, their banks being fringed with larger and thicker timber than is found further east, the aspect of the country becoming distinctly more tropical as one goes west. The Landolphia vine is here abundant, as well as the cotton plant, much cultivated before the advent of European and Indian calicoes. Near the Kapopo station, which has been built close to the Linyama stream, the natives are of many different tribes, the Wabwera being apparently most amenable to civilizing influences, though all resent the stoppage of the former lucrative trade in slaves and ivory with the Mambunda from the west. It is fortunate that the comparative sparseness of the population has saved from destruction the grand clumps of virgin bush with their wealth of

* The Chambezi and Chozi are shown in their correct relations in the map accompanying Mr. Wallace's paper in the *Journal* for June, 1899.

† Map, p. 668.

rubber vines, which elsewhere have been sacrificed to the primitive methods of cultivation. Limestone of great richness underlies the whole surrounding country.

The journey was continued on June 14 for Chepepo. After the first 20 miles the aspect of the country gradually changes, the dark rich soil, high grass, and timber giving place to ground of far less fertility and scrub bush. Thirty-five miles in a south-south-westerly direction led to the Lukanga river, here fully a mile wide, but blocked with papyrus and aquatic plants, the ford being extremely treacherous and difficult, with depths in places of from 4 to 12 feet. On the south side the country is desolate in the extreme, being absolutely flat and swampy, with only a few sparse clumps of low scrub. The chief Chepepo, acknowledged as chief by a considerable portion of the Walenji, is an intelligent man. As a south-west course would have led across the great Lunjofwa swamp, guides were obtained for the Kavu river, the Lukanga being again crossed some 12 miles west of the ford above mentioned. It was here some 70 yards wide and very deep, but with no perceptible current. The northern bank is bounded by swamps for a distance of 6 miles, beyond which soft white sandy soil with thin bush appears. After a march of 20 miles south-west through country of this description, the huge swamps of the Kavu were reached, and camp was pitched on the east bank on June 20. The Kavu was here some 200 yards wide, deep, with a slow current, the swamps extending along both banks. The Lukanga was again struck near its junction with the Kavu, and crossed in canoes. The dreary flats now gave place to slightly undulating ridges of bush, on the crest of one of which Kasonkamola, the paramount chief or the Walenji, is settled. Traders do not give him a good reputation, but, though at first suspicious and reserved, he soon thawed, and allowed his people to bring in food. Fourteen miles further on, the village of Sitanda,* a pleasant-faced, light-coloured native, who shares with Kasonkamola the control of a large portion of the Walenji tribe, was reached, the intervening country being extremely fertile and well peopled. One of Sitanda's sons and some other relatives accepted with alacrity an invitation to visit Fort Jameson.

From Sitanda's the return journey *viâ* the junction of the Loangwa and Zambezi was commenced, a divergence from the direct route being made for the purpose of visiting Longo's village on the southern border of the great Lunjofwa swamp. Thence an easterly course was followed to Shuiyungi's, after which a march of 30 miles through broken, fertile, well-watered country led to the edge of the Mchinga plateau, a descent being made by a steep and tortuous path into the Mlungushi valley, thickly peopled with Aluano. In 3 miles a drop of 2400 feet was registered by aneroid. The Aluano are short, but powerfully built, somewhat repulsive in appearance, and dwell in poorly built and extremely dirty villages. They raise immense crops of "Mapira" along the beds of watercourses. The valley was traversed for three days in a south-easterly direction, the path winding among stony and rugged hills. Afterwards it ascended the Pembeni range to a height of 3400 feet, and for 35 miles followed the highest ridges of this chain through an uninhabited and poorly watered tract. A descent was then made into the valley of the Pochera, a large affluent of the Rufunsa, by the valley of which last the junction of the Loangwa with the Zambezi was reached on July 11. The point of British territory at the junction known as Feira, was once the site of a Portuguese settlement, and the sandstone from its ruins is being used in the construction of the present Administration station. This is being built on a small hill rising vertically 200 feet from the Zambezi, the land below being well suited for the laying out of a small township. The country around is moderately well peopled with Chikunda.

Sitanda's village was Mr. Selous's terminus in 1878.

The Zambezi is here about 550 yards wide, running fast and deep. The Loangwa widens at the junction to about 1000 yards, the permanent channel skirting the stony point on the British side. For about half a mile up it is fairly deep, but beyond that distance the water reached at the time only to the knees. Near the junction the banks of both rivers are well suited for the discharge of cargo from steamers and barges. The small Portuguese town of Zumbo lies under a high peak of the Madzanswa range, about 2½ miles due east of Feira.

Starting again on July 18, the expedition proceeded for 50 miles up the west bank of the Loangwa to Almoso's village, at which point the river divides into three channels, to unite again 10 miles lower. Water existed in July in the easternmost of these only, and even this was so narrow, tortuous, and broken by rocky rapids as to probably place the limit of navigation by steamer, even in the wet season, below the union of the three channels. Waggon transport from Feira to this point would be easy during the dry season, but at Almoso's the road enters hilly ground, and a considerable expenditure would be necessary before it could be used for wheeled traffic. The Loangwa was now crossed, and the valley of the Mezi—at present taken by the Portuguese as their northern boundary—ascended to the Senga plateau, on which are numerous settlements of former slaves of the Angoni. Fort Jameson was reached on July 30, thirteen days after Feira had been left. The accompanying map is based on observations by prismatic compass.

PROF. GREGORY'S EXPEDITION TO LAKE EYRE.

THE chief scientific results of his recent expedition to the Lake Eyre basin were sketched by Prof. Gregory in an article contributed to the Melbourne *Age* for February 22 last, of which the following is a condensed summary. Prof. Gregory began by pointing out the great importance of the part played by Lake Eyre in the physical history of Australia, which is such that the lake may fairly be termed the geographical centre of the continent. Not only was it once the great distributing centre, but it is involved in each of the four main geological features of Central Australia, viz. the great artesian basin of Queensland; the ancient plateau of Western Australia; the great valley of South Australia; and the lake plain which extends eastward to the Darling. Nor is it of less importance as regards the zoology, botany, and anthropology of the surrounding region.

Lake Eyre is, however, now but the dead heart of Australia. It absorbs the drainage of 500,000 square miles of country, passing on none of its water to areas which might make more use of it. Animals and plants are continuously migrating into its basin from the surrounding highlands, but are unable to make good the internal waste. The desert itself produces nothing new, and its plants and animals are few and stunted, barrenness and inertia being the leading characteristics of a region once fertile and creative. The reasons for this change are to be sought in the geological history of the Lake Eyre basin, of which Prof. Gregory gives an outline from the time when the coalfields were being

formed in Queensland. The region was then slowly sinking beneath an encroaching sea, which eventually advanced from the gulf of Carpentaria as far south as the northern end of Lake Torrens and extended east to the coast ranges of Queensland. After its retreat, and the formation on dry land of the "Desert sandstone" above the blue shale that had been deposited on its floor, a great uplift occurred along the Queensland hills, and the streams which descended from these on the west plunged under the blue shales and accumulated as the great artesian reservoir of Central Australia. After this came a great series of Earth-movements which impressed on South Australia its main existing geographical features, including the great valley of Spencer gulf and Lake Torrens, and the mountain system which runs obliquely, north-westward, from the Flinders to the Denison range, damming back the artesian waters.

About the same time the Lake Eyre country began to sink, and this movement lasted until, as at present, the lake margin was 39 feet below sea-level. The drainage system was thus disturbed, and the streams which had before probably flowed south-eastward, to the Darling or to an arm of the sea occupying the present Murray valley, were now diverted to this central basin, where they accumulated as a vast inland sea. The rainfall was considerable, and the surrounding steppes were probably well grassed and fertile, large trees—now represented by their petrified trunks—growing on the plains. The water of the lake was probably fresh, and its extent three times as great as at present. On its shores lived an assemblage of giant kangaroos and wombats, as well as wallabies, bandicoots, and marsupial rats, while in the lake and its entrances were crocodiles, the primitive Queensland mudfish (*Ceratodus*), and huge bony fish, all of which have long since disappeared from those waters. Unfortunately, however, a period of diminished rainfall set in, and the lake decreased in size and lost its outlet, partly through the warping of the surface and accumulation of *débris*. It continued to lose water by evaporation, became salt, and the fish and crocodiles were killed. With the progressive decrease of rainfall the vegetation withered, the succulent herbage giving place to dry spiny plants. The giant marsupials died of hunger, and the whole region was blasted into desert.

One of the main points on which Prof. Gregory hoped to throw further light was the age of this desiccation of the Lake Eyre basin, and he was fortunate enough to obtain one important piece of fresh evidence, in the discovery of specimens of the dingo in association with the extinct marsupials. No trace of man or his implements was, however, found with their bones, and Prof. Gregory considers this a strong indication that the animals were not contemporary with man, although some authorities have held that the dingo was introduced into Australia by human agency. He therefore thinks that the great climatic changes

above sketched occurred after the introduction of the dingo, but before the advent of man to this region. The evidence of the native traditions seems also to support this view. The "Kladimakara" legends clearly relate to two different animals—one the diprotodon, which answers to the description of an animal with a horn in the middle of its forehead; the other the crocodile, as it is described as reptile-like, living in waterholes, and devouring people who ventured into the pools. The legends also show variations in other respects, some speaking of the Kadimakara as descending from the sky by gum-trees, while in others it is the ancestors of the present tribes, who are supposed to carry on communication with the sky by means of a tall pole. These variations render it probable, in Prof. Gregory's opinion, that the aborigines did not reach Lake Eyre till the giant marsupials were extinct. As is the way with primitive people, they localized their old stories in their new homes, adapting them to suit local conditions, and to explain the great bones found on the dry beds of Cooper's creek and the Diamantina.

RECENT EXPLORATION IN ALASKA.*

During the past few years the United States Government has continued the exploration of its northern territory with great activity. Both the War Department and the Geological Survey have been at work, the chief object of the former being to construct a road to the upper Yukon, which should lie entirely within the territory of the Republic. Parties have therefore examined the Copper river basin and the adjoining country, while the Geological Survey parties have traversed the greater part of Southern Alaska and obtained a general knowledge of its structure.

The western extension of the St. Elias range is divided by the two main streams of the Copper river into three branches. The valley of the Chittena separates the short Mount Wrangell group from the coast range, which passes round Prince William sound into the Kenai peninsula and Kodiak island, while from the source region of the White and Tanana rivers the Alaskan range runs westwards beyond the Cantwell river and then bends southwards, forming the watershed between the Sushitna and Kuskokwim, and continuing into the Alaskan peninsula and the Aleutian islands. The Kenai mountains rise to heights of 6000 to 8000 feet, and are intersected by broad high valleys. The Chugatch range, which extends from Turnagain arm and Portage bay to the Copper river, is still loftier and more rugged. It probably attains its maximum height in a group of peaks north of Port Wells, and from this point slopes eastwards and westwards. Between the Matanuska and Sushitna rivers lie the Talkeetna mountains, not much lower than the Alaskan range in the west, but probably only 6000 to 7000 feet in height towards the Matanuska river. Between these ranges an interior basin, 1500 to 3000 feet above sea-level, extends eastwards to Mount Wrangell, drained in the west by the Sushitna tributaries, and in the east by the Copper river.

* 'Compilation of Explorations in Alaska,' 1900; 'Reports of Explorations in the Territory of Alaska, 1898, 1899,' Alaska, 1899; 'Copper River Exploring Expedition,' 1900; U.S. Geological Survey, Twentieth Annual Report, Part vii.; 'Alaska' (Harriman Alaskan Expedition), 2 vols., 1901; *National Geographic Magazine*, November, 1901.

The northernmost extremity of the great St. Elias group, near the Soolai pass, was named by Mr. Oscar Rohn, in 1899, Mount Abercrombie. White river descends from the Russell glacier on its northern flank, and is accompanied by a high range on the south. North of the sources of the White river are the Nutzotin mountains, the highest peak of which (over 10,000 feet) has received from Mr. A. H. Brooks the name of Mount Allen, and are succeeded to the north-west by the Mentasta range, between the Copper and Tanana rivers. Immediately south of the Tanana the Alaskan range breaks up into isolated groups, one of which culminates in Mount Kimball, 10,000 feet high, east of the Delta river, while Mount Hayes, to the west of this river, rises to 14,000 feet. West of the Sushitna river the range attains its maximum elevation in Mount McKinley (lat. 63° N., long. 149° W.), the Bolshaya (big) of the Russians, which, standing 20,464 feet above sea-level, is the culminating point not only of Alaska, but also of the North American continent. The Tordrillo mountains, west of the lower Sushitna and the Chigmit, west of Cook inlet, are also very bold and rugged, containing summits 11,000 to 15,000 feet high. In the latter are the two well-known volcanoes Redoubt and Iliamna, 11,000 and 12,000 feet respectively, the latter still steaming. Of the Mount Wrangell group, Mount Wrangell itself is the most prominent feature, towering above its neighbours with a height of over 17,000 feet. To the north and north-west are Mounts Sanford and Drum, and Mount Blackburn to the south-east. Mr. Rohn has not been able to identify Mount Tillman, named by Lieut. Allen, who obtained occasional glimpses of the group from the Copper river in 1885. From Mount Blackburn a range surmounted by a prominent peak, Mount Regal, runs in an easterly direction towards Mount Abercrombie, and from Mounts Wrangell and Sanford a range attaining to heights of 5000 to 6000 feet runs north-eastwards to the Mentasta range.

The White river, which owes its name to the pumiceous volcanic ash with which it is loaded, was discovered in 1850 by Mr. Robert Campbell, of the Hudson Bay Company, and was ascended in 1891 by Dr. Willard Hayes and Lieut. Schwatka. It flows for 200 miles with a rapid current, cutting in its lower course through the Yukon plateau. Broad flat valleys connect its basin with that of the Tanana, and a portage over flat swampy country brought Mr. Brooks, in 1898, from the Snag, an affluent of the White, to Mirror creek, by which he reached the Tanana. Both the Tanana and its great western headwater, the Nabesna, break through the line of the Nutzotin and Mentasta ranges, the latter draining the triangle formed by Mounts Wrangell, Blackburn, and Regal. In the upper course of the Tanana and the section below the trail to Forty-mile river, where there are numerous rapids, the current is swift, but in its middle course the river winds along with a slow current, in some places consisting of a chain of lakes. On the northern side the country is an upland studded with relict hills of the Yukon plateau, such as the Ketchumstock hills. The southern tributaries, the Delta and Cantwell, flow through the Alaskan range from the edge of the Copper river basin. In the lower Tanana all the tributaries make a downstream bend before entering the main stream, indicating a reversal of the drainage, and probably at one time the Tanana above the Volkmar and Goodpaster flowed to the White, which then discharged its waters into the sea by the Alsek valley.

The Etna or Copper river, 300 miles long, has its source in the angle between the Alaskan range and the mountains running north-east from Mount Sanford, a flat area studded with innumerable lakes and bogs. Bending round the Mount Wrangell group, it has cut its bed to a depth of 500 to 800 feet through a recent bed of silts and gravel probably 1000 feet thick. This plateau, near the middle of the basin, has an altitude of 1500 feet, and it rises westwards to 1700 feet at the

foot of Klutena lake, where it joins the vast tundra plateau which forms the watershed towards the Sushitna. Below the mouth of the Chittena the Copper river enters Wood's cañon and commences its course through the Chugatch mountains. It has a current averaging 8 miles an hour, and most of its tributaries are too rapid for navigation. On the right bank it is joined by the Klutena, which rises in a glacier connected with the great Valdes glacier and flows through Lake Klutena or Abercrombie, an elongated depression in the river-valley 30 miles long, probably occupied by a glacier in former times. The largest tributary of the Copper is the Chittena, the Chitty-na or Copper river of the Indians, of which the northern branch, the Nezona, rises in a large glacier on the eastern flank of Mount Regal, which also gives rise to the Tanana. The ascent of the Copper valley from the delta being exceedingly difficult both by land and water, Captain Abercrombie, to whom the task of constructing a military road has been entrusted, chose Port Valdes, further west, as his point of departure. The inner bay, 10 miles long by 4 wide, is open all the year round. At its eastern end the Lowe river enters, descending from Marshall pass, 1700 feet above sea-level, on a watershed whence the Taznuna flows to the Copper. A road is being made up the Lowe river and over the Thompson pass, 2840 feet, to the valley of the Tonsina, a tributary which joins the Copper between the Chittena and Klutena, and will be continued up the Copper river basin. The Tanana may be reached by the Slana river, the Mentasta lake and pass (2300 feet), and the Tok river, and thence the journey may be continued to Forty-mile river and Eagle City.

Cook inlet receives the Matanuska and Sushitna rivers. The former, more than 100 miles long, rises on the north side of the coast range near the head of the Tazlina, which flows through Lake Pleveznie to the Copper. The Matanuska affords easy access to the interior, the watershed at the head of Delta river being only 3000 feet above sea-level. It flows at a rate of about 10 miles an hour, and has cut down its bed 400 to 500 feet below an old valley floor. The Sushitna rises in the angle between the Talkeetna and Alaskan ranges, and one of its headstreams probably drains Lake Louise at the edge of the Copper river basin. Its great tributary, the Chulitna, runs a little west of south at no great distance from the main river, receiving many affluents from Mount McKinley and the neighbouring peaks, and enters the Sushitna about 80 miles above its mouth. From its sources, two passes, 3700 and 4200 feet high respectively, lead into the Tanana basin, in all probability to the Cantwell river. The Sushitna flows through a picturesque gorge which, like that of the Matanuska, has been cut in the bottom of an earlier, though comparatively recent, valley. Twenty miles from the delta of the Sushitna the Yentna enters, coming, it is said, from Mount McKinley. Along this river and its right-hand tributary, the Skwentna, Mr. Spurr travelled in 1898 to the Kuskokwim through the Tordrillo mountains, making a portage over a pass 4400 feet high. The Kuskokwim, running northwards, skirts the Tordrillo mountains, and then breaks successively through two parallel ridges, the Teocalli and Terra Cotta, emerging on to a broad gravel plateau which slopes towards the west. For 100 miles it flows swiftly down the plateau, and then enters a flat country, through which it meanders down to the trading-post, Vinasale, about 390 miles above Bethel. Mr. Spurr also ascended the Kanetok river and crossed to the Togiak lake, unknown before, returning to the coast by the Togiak river.

The foundation of the country is composed of gneissic rocks in the east, while in the west granite is the base-rock. Above these lie schists and Silurian beds, except in the south-west, where the oldest formation observed by Mr. Spurr was the Tachatma (tributary of the Kuskokwim) series, corresponding generally to the Takhandil series of the Yukon, in which Carboniferous and Devonian fossils have

been found. Cretaceous rocks have been observed in the Copper river district, on the Matanuska and in South-Western Alaska. The Alaskan mountains seem to have been elevated by foldings in post-Cretaceous times, for the Cretaceous beds are folded with the underlying strata, and the movements probably continued down to the close of the Miocene period. In South-Western Alaska the main axis of folding runs from north-east to south-west. Secondary folds are everywhere present, and Mr. Brooks found that the main direction on the White river, north-west to south-east, became the secondary on the Tanana. Whether all the ranges were elevated at the same time is as yet uncertain. Possibly the Chugatch mountains are of later date than the Alaskan range. In the Pliocene age, after a drainage system had been developed, a subsidence took place, the sea filling the area between the Alaskan and Chugatch ranges, and then, partly by glacial action, the gravels were laid down, which, along the Matanuska, now rise to a level of 2700 feet. In recent times the land has risen, in some places to as much as 3000 feet above its lowest position, the stages of elevation being marked by terraces. When a new system of drainage was developed, the Copper river basin probably discharged its water into Cook inlet, until a stream, cutting back its course through the Chugatch mountains, tapped the lake in which the fine silts of the Copper river basin were deposited. Intrusive rocks are of frequent occurrence, and auriferous quartz or placer gold is found in most of the valleys. Volcanic action has manifested itself in pre-Cretaceous times and down to the present day. Mount Wrangell often send up vapour, and in 1899 discharged a stream of lava. Copper is worked, and iron, cinnabar, arsenic, antimony, and manganese have been reported.

Boulders of unmistakably glacial origin among the silts of the Copper river basin indicate a more extensive glaciation in Pleistocene times than at present. There does not, however, appear to have been a universal glaciation of the whole surface, and, indeed, in South-Western Alaska the glaciers were, in Mr. Spurr's opinion, not much more numerous or larger than at the present day.

The Harriman expedition, under Prof. Brewer, made an important exploration of the southern coast in 1899. Its chief geographical discovery was that an inlet about 20 miles from the mouth of Port Wells, apparently closed by a glacier, opened into a beautiful fjord 15 miles long, to which the name Harriman was given. Of the work of parties sent out in 1901 by the U.S. Geological Survey, no full account has yet been published. Mr. Peters crossed from Bergman, a trading-post on the Koyukuk river, to the Colville river and the Arctic ocean, crossing the watershed 100 miles from Bergman. Rolling tundra extends thence to the coast. Another party, under Mr. Mendenhall, reached Bergman by the Dall and Old Man rivers, and made its way westwards to Kotzebue sound. Mr. Gerdine completed the mapping of Seward peninsula, and Mr. Brooks visited Prince of Wales island and the mainland to the north-east. There are still tracts between the upper Kuskokwim and the Yukon, and on the arctic slope between the Canadian boundary and the Colville river, and between Howard's route in 1886 and the western coast, which have not yet been explored, and the geology of Southern Alaska is by no means thoroughly worked out.

THE FJORDS AND BAYS OF ICELAND.

DR. THORODDSEN, the indefatigable explorer of his native island, has contributed to the *Geografisk Tidskrift*, Bd. 16, Hefte 3 and 4, a paper on the contours and origin of the bays and fjords. The coast-line of Iceland, over 3700 miles in length, is deeply indented, except on the southern side, where it is generally low and

consists of sandy and gravelly flats, the *débris* carried down by the innumerable glacier streams. The complete absence of fjords is, however, only apparent, for were the sea-level raised 300 to 600 feet they would be fairly frequent. The inlets on the Icelandic coast are of two kinds—large bays of various forms and fjords proper, which are generally rather narrow, and sometimes the two are combined. The two largest bays are Faxebugt on the south and Bredebugt on the north of Snæfelsnes. Faxebugt, 40 miles long by 55 broad, becomes gradually deeper towards its mouth, where it sinks to 50 to 60 fathoms. At its head lies a stretch of low land, 390 square miles in area, called Mýrar, which has an elevation of only 60 to 100 feet, and is enclosed by heights of 650 to 1600 feet. The valleys that run into it have been carved out by erosion, while the Faxebugt and low land are an area of subsidence separated by faults from the main mass of the island. Probably the subsidence took place in Tertiary times, but small movements have continued since even up to the present time, earth-tremors being very frequent in this neighbourhood. At the end of the Tertiary period the valleys and fjords (Hvalfjördr and Borgarfjördr, etc.) opening into the depression were eroded till they assumed much the same form and depth as at present. Just before the Glacial period, or possibly during the first glaciation, conglomerates were accumulated here and there in the valleys and on the low land; somewhat later, doleritic lavas streamed down the erosion channels, glaciers descended along every valley, ground down the lava, and carried away part of the conglomerate; then the sea rose over the flat land up to the valley mouths, and rivers from the glaciers deposited on the bottom a layer of clay containing *Yoldia* and other arctic shells. At the end of the Glacial period the sea retired to the present coast-line.

Snæfelsnes is a *horst* produced by the subsidence of the Faxebugt and Bredebugt. The latter also originated in Tertiary times. Another bay caused by dislocation also existed in the Glacial period in the southern lowland, but its bottom is now above water. The fjords of the north-western peninsula are shown by Dr. Thoroddsen's description to be typical fjords cut through flat or slightly sloping layers of basalt. Some of the smaller ones are deeper towards the head, and most of the others are rather deeper in the middle than at the mouth. The valleys are short and end in steep heads. Striæ are frequent, but moraines are not extensive; perhaps they have been swept away into the sea. Húnaflói is, doubtless, a subsidence basin, though its geology is not sufficiently known, and therefore its origin cannot be proved. Between it and Skagafjördr lies the peninsula Skagi, a singular geological structure, quite different from the other promontories of the north coast west of Skjälfandi, and later than these. Volcanic eruptions have taken place here at a later period, and therefore it is not improbable that subsidences have occurred on both sides. As far as Skjälfandi, the northern land consists of slightly tilted or horizontal beds of basalt, but here the structure suddenly changes, later volcanic rocks appearing in a broad belt which extends eastwards to Langenes. On the west they are bounded by the longest and most important line of fracture in Iceland, which runs along the west coast of Skjálfandi and the Bárdar valley into the interior, where it can be traced for 60 miles southwards. The Skjálfandi and the succeeding Axar and Thistil fjords are similar in contour and depth, have all been produced by subsidence, and have no resemblance to true fjords. All the fjords of the east coast north of Seydisfjördr have only a small depth and a continuous slope outwards. Seydisfördr, begirt by mountains 3300 feet high, is somewhat deeper, and has in the middle a basin 40 to 47 fathoms deep, while it is shallower at the mouth. Beyond Beru fjord to Reykjanes there are no fjords, but only very shallow lagoons.

The inlets on the Icelandic coast are either bays produced by subsidence or

fjords carved out by erosion. The latter occur either as ramifications of the large bays or in independent groups opening out directly to the sea. The bays are generally broad, with depths small in comparison to the area, and bottoms sloping continuously outwards, whereas the fjords which run into them are often of great depth, and contain hollows going down to a lower level than that of the main bay. Many of the large bays are certainly the result of faulting and subsidence, while the origin of others is not determined because their geology is imperfectly known, but they are probably due to the same cause. The fjords are similar to those of other countries, but they are neither so deep nor do they branch out into so many arms. There are also no deep sounds connecting different fjords. The only two large groups of fjords opening out to the sea are in the north-western peninsula (eight main fjords with eighteen branches), and on the east coast, between Hjeradsflói and Lón (ten main fjords with three small branches).

Iceland stands on a submarine plateau, in general marked out by the 100-fathom line. The plateau has a breadth of 60 miles and more, and is steepest off the southern coast, where the depth at only 11 miles from the shore sinks from 100 to 700 fathoms. Off the north-western peninsula, on the other hand, it has a breadth of 55 to 60 miles, and then slopes gently to a depth of 700 fathoms at a distance of 170 miles from the coast. Peculiar to the Icelandic plateau are the regular indentations in the 100-fathom line all round the coasts, which indicate the existence of submarine fjords closely connected with the land valleys and fjords. The fjord basins run straight out, their mouths lying at a depth of about 130 fathoms, beyond which they entirely disappear, so that it may be assumed that the coast-line stood at this level at the time of their formation. The submarine plateau must have been moulded by marine abrasion, accompanied by a positive displacement of the coast-line. It cuts into the land, like all abrasion surfaces, horizontally, without regard to the formations and their older lines of fracture. In the middle of the Miocene age, Iceland was a much more extensive land than it now is, and was built up of horizontal basalt beds and plateaus, which were rent asunder in various ways by the violent tectonic movements at the end of the period. Between the Miocene period and the deposition of the Red Crag, lying in thick beds unconformably on the basalt in Skjálfandi, the abrasion must have taken place which removed about 60 miles of the solid mass of the island, 1600 to 3200 feet thick. At the end of the Pliocene age the land gradually rose 800 feet, and the valleys were excavated by streams and floods descending from the older valleys in the interior. Possibly this erosion took place in the earliest times of the Glacial period, when glaciers began to appear on the inner highlands, but had not yet spread over the whole land. It was then, also, probably that the conglomerates were formed which filled the Tertiary valleys of Western Iceland, and are distributed over the southern lowland.

Dr. Thoroddsen describes more or less minutely all the important indentations, and gives reasons for the conclusions he has arrived at. He also discusses the basalts and other volcanic rocks, from Ireland and Scotland to North-East Greenland, which now occupy an aggregate area of 54,000 square miles.

THE DEFLECTION OF THE PLUMB-LINE IN INDIA.*

By E. A. REEVES.

THE question of the deflection of the plumb-line from its true vertical position, owing to the unequal effect of gravity occasioned by irregularities in the formation of the Earth's crust, is one that calls for most serious consideration whenever a complete trigonometrical survey of a country is undertaken. Such irregularities cause errors in the astronomically determined positions, inasmuch as they affect the levels of the theodolite with which the observations are taken. Even in comparatively flat countries, such as Russia, this is a subject which cannot be ignored, and near Moscow, on a line 60 miles long, running nearly east and west over a plain, northerly deflections of 8″ are found, while along a parallel line 9 miles to the south the plumb-line hangs vertical. Along a third line, 9 miles further to the south, there is a southerly deflection of 8″. This is doubtless an exceptional case, and there are probably few places on the Earth's surface with so great a change in the direction of the plumb-line in so short a distance. Yet, as might be expected, in India, with the massive range of the Himalayas stretching across its long northern frontier, the question is by no means insignificant, and in very early days of the Indian trigonometrical survey it was recognized that it would have to be carefully considered. It was found, for instance, that the latitudes of places resulting from observations taken with the best instruments and computed with the utmost care, would not coincide exactly with the results obtained by triangulation. Similar differences were also noticed in the longitudes and azimuths. Although these differences nowhere amounted to more than a few seconds, it soon became evident that they were not accidental, nor due to errors of computation, and could only be attributed to the deflection of the plumb-line due to inequalities in the attraction of gravity. Naturally, the great mass of the Himalayan range was turned to as the principal cause of these abnormal conditions, and in the earlier days of the Survey of India a good deal was written upon the subject with a view to its fuller investigation. Elaborate computations were, amongst others, undertaken in 1852 by the late Archdeacon Pratt, of Calcutta, at the request of Sir Andrew Waugh, the then Surveyor-General of India, the results of which were afterwards given in the *Philosophical Transactions of the Royal Society*. As a consequence of these investigations it was pretty generally accepted that the effect of the Himalayas on the direction of the plumb-line in India was compensated by the deficiency of matter beneath that range, or some other cause, and it has for the last forty years or so been considered impossible that the range can exert any influence upon the direction of the plumb-line so far south as Central India; thus it was supposed that all observed discrepancies between the astronomical and geodetic positions of places at any considerable distance from the Himalayas were due to local inequalities. The principal reason for believing that the attraction of the Himalayas was counteracted by an invisible cause was the fact that the observed effect of the attraction of the Himalayas on the plumb-line at Kaliána (in lat. 29° 30′ 48″), the northern terminus of the Indian Arc, is 5″·236; whilst the attraction of the apparent or

* 'The Attraction of the Himalaya Mountains upon the Plumb-line in India.' Considerations of Recent Data by Major S. G. Burrard, R.E., Superintendent Trigonometrical Surveys. Published by direction of Colonel St. G. C. Gore, R.E., Surveyor-General of India. Professional Paper No. 5. Dehra Dun: printed at the Office of the Trigonometrical Branch, Survey of India. 1901.

superincumbent mass of the Himalayas at that point is sufficient to produce a deflection of 27″·853, according to the calculations of Archdeacon Pratt. But, as will be seen later on, Major Burrard, in the report now under consideration, clearly shows that, owing to our more perfect knowledge of the vast mountain systems of Northern India, and a more complete acquaintance with the depths of the Indian ocean, together with other reasons, it is necessary that the argument should be reconsidered, and the computations made over again; and when this is done, he comes to the conclusion that there is no reason to suppose that the effect of the Himalayas upon the direction of the plumb-line does not extend to Southern India, and even at Cape Comorin the range may cause a deflection of one or two seconds.

The question of the deflection of the plumb-line in India is surrounded with many difficulties and obscured by apparent inconsistencies; nor does Major Burrard profess to have finally cleared up the matter, although his work is most important as being a re-investigation of the subject, based upon the most recent data. Before a thoroughly satisfactory conclusion can be arrived at, many more observations must be taken and additional information obtained; but, as Major Burrard states in his preface, "a periodical investigation is essential, if we wish to design the most profitable programmes of future work." For many years the subject may be considered to have been in abeyance, except for the ever-accumulating evidence necessarily resulting from the progress of the Indian Trigonometrical Survey, and it was only seriously revived by the paper read by the late General J. T. Walker (Surveyor-General of India) before the Royal Society in 1895. Before it is possible to ascertain how much the Himalayas deflect the plumb-line throughout India, it is, of course, necessary to clear each observation station from the effect of *local* attraction, and in order to do this, General Walker in his paper proposed the "group" system, *i.e.* that each station should be surrounded by other stations at short distances from it, and that observations should be taken at all of these, from which the amount of *local* attraction could be ascertained. In the same paper he attempts to explain the preponderance of northerly deflections throughout India, by assuming that local attraction is producing a *southerly* deflection at Kaliánpur, the station of reference of the Indian Survey.

This paper brought the question again into prominence, and it was decided by the Survey of India to carry out General Walker's suggestions, and establish a "group" of observation stations around Kaliánpur, in order to determine the local attraction at that place.

The result of the observations taken at these stations is given in Major Burrard's report, on page 7 of which appear the three following values of the latitude of Kaliánpur:—

	°	′	″
Value adopted in computations of the triangulation	24	7	11·26
Mean observed value of six different observations taken at Kaliánpur itself, by different observers between 1824 and 1899 (the greatest difference between them being 0″·85) ...	24	7	10·97
Value derived from the group	24	7	11·57

On the assumption that the last of the three, the value derived from the group is freed from the effect of local attraction, it is deduced that the astronomical zenith at Kaliánpur is displaced 0″·60 to the south, and that there is a deflection of the plumb-line in the meridian at Kaliánpur of 0″·60 to the *north*. This result was quite unexpected and surprising, for instead of the local deflection being southerly at Kaliánpur, as General Walker had predicted, it was thus found to be *northerly*. After this the whole subject was reopened; observations were extended, fresh computations made from the latest information, old theories and conclusions

reconsidered, the account of all of which Major Burrard gives in his report, which represents a vast amount of most painstaking work.

This report consists altogether of one hundred and thirty pages of letterpress, in addition to numerous charts and diagrams, and is divided into seven sections, as follows: I. On the errors of the initial values of latitude and azimuth in India. II. The deflections at Kaliánpur calculated from the configuration of the ground in the vicinity. III. The Pendulum Observations at Kaliánpur. IV. (*a*) The influence of the Himalaya mountains and of the Indian ocean on the plumb-line in India; (*b*) the disturbance of the sea-level; (*c*) geological considerations. V. Comparison of calculated with observed values of deflections in the meridian. VI. Comparison of calculated with observed values of deflections in the prime vertical. VII. It is inferred that a hidden cause in Central India is masking true Himalayan effects. These are the headings of the principal sections of the work, and from them some idea may be obtained as to its scope and arrangement, which, as might be expected, is clear and satisfactory. In addition to these chapters there are two appendices, one giving a description of the stations of the Kaliánpur group, and the other the results of the azimuths observed in India and Burma. A useful epitome of the work is also given at the commencement.

There are altogether fourteen charts and diagrams, which serve well to illustrate the text, besides numerous pages of tabular matter. Some of the diagrams are very ingeniously arranged, and convey at a glance a great deal of information. Among the more interesting of these are those showing the local attractions in the meridian, and in the prime vertical at the stations of the Kaliánpur group, and the outline charts of India illustrating the positive and negative areas of (O–C) in latitude and azimuth. Positive areas are tinted red, and negative left white. Throughout the work "O" is taken as the astronomically observed latitude or azimuth, and "C" that computed from the triangulation. In the case of latitudes, if the plumb-line at any station is attracted to the north, the zenith will be displaced to the south, the observed latitude or O will be too small, and (O–C) is then a negative. As regards azimuths, if the plumb-line at any station is attracted to the east, the zenith will be displaced to the west, the observed azimuths or O, measured from south by west, will be too small, and (O–C) is again negative. When the opposite is the case, O–C is considered positive. It would have been interesting if specimens of the actual computation of the astronomical positions had been given, as well as a description of the instruments used, and the methods employed for eliminating the effects of refraction, which must be a matter of special importance when the whole argument sometimes depends on a second or two of arc, or indeed, as it is at times, the fraction of a second. As a frontispiece is given a cross-section of the outer Himalayan ranges on the meridian of 77° 25′, constructed from the contoured maps of the Indian Survey by Colonel St. G. C. Gore, R.E., Surveyor-General of India.

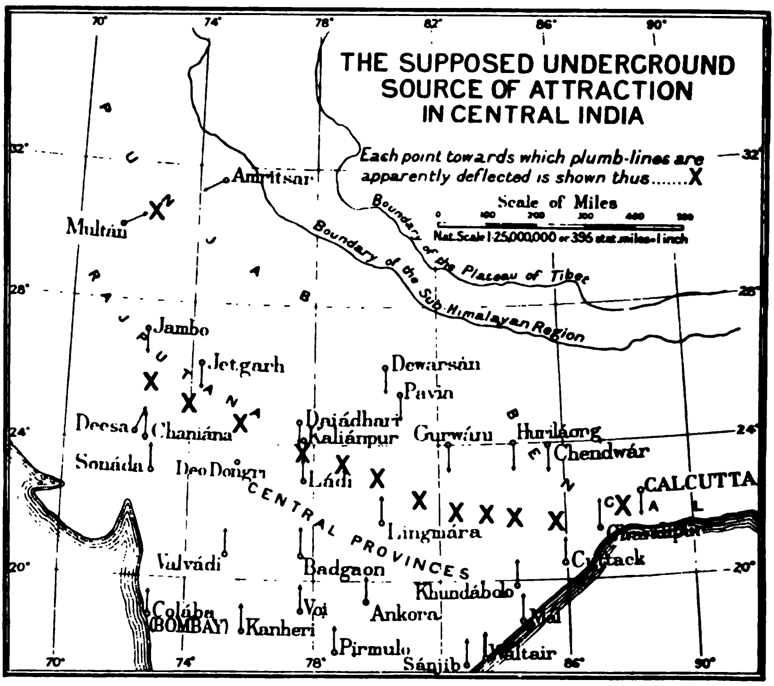
In his preface Major Burrard acknowledges the great assistance he has received from Mr. C. H. McA'Fee, Extra Deputy Superintendent, who has taken charge of the publication of his work; from Mr. C. L. Griesbach, C.I.E., Director of the Geological Survey of India, who has supplied him with valuable geological information, and several others. He also states that "a sense of loyalty to General Walker renders criticism of his theories an unwelcome task:" "and that such criticism can only be based on data that were never at his disposal, and that have been accumulated since his death." Many of the formulæ used in the computations are those arranged by Colonel A. R. Clarke, C.B., R.E., F.R.S., and given in his well-known work on geodesy.

It may be well now to state the principal conclusions which Major Burrard

considers these investigations point to, although he is evidently prepared to admit that further information may lead to their modification. He sums them up himself in the following words:—

1. "It is now believed that the coincidence of the change of sign of the deflections with the parallel of the station of origin is accidental, and possesses no significance." (It was previously considered an important and suggestive fact that at lat. 24° N., the latitude of Kaliánpur, the station of origin or reference, the sign of the deflection changed from north to south.)

2. "The change of sign in the deflections along the parallel of 24° is attributed to a great underground chain of excessive density stretching across India from east to west for over 1000 miles, the effects of its attraction being visible from lat. 16° to lat. 30°." (Chart No. 12 of the report, which is here reproduced, shows this supposed underground source of attraction.)



3. "This chain is the probable cause of the positive deflections north of lat. 24°, and of the negative deflections south."

4. "It marks the true effects of Himalayan attraction: Himalayan effects thus suffer from both compensation and obscuration."

5. "The longitude arcs of the Punjab lead to the belief that the underground chain tends to the north-west in Rajputana, and maintains a parallelism with the Himalayas."

6. "The effects of the chain are superimposed on those of a far-reaching Himalayan attraction, the latter perhaps deflecting the plumb-line at Cape Cormorin through one or two seconds of arc."

7. "South of the chain, from lat. 20° to lat. 8°, the northerly deflection of the plumb-line has been observed to decrease gradually for 800 miles, the total decrease amounting to 10″ from −8″ in lat. 20° to +2″ in lat. 8°; this decrease is possibly a Himalayan effect."

REVIEWS.

ASIA.

The Philippine Islands.*

That the acquisition by America of a group of islands so importan , so rich, and, it may be added, so little known as the Philippines should be the signal for the appearance of several works upon the archipelago is no more than might be anticipated. Mr. Foreman's long acquaintance with Manila, and his knowledge of island politics, fully justified his volume; while that of Prof. Worcester was no less acceptable as the personal experience of a naturalist who has perhaps travelled as widely among the islands as any European now living. But neither of these authors presented us with what is felt to be a distinct want here not less than in America, namely, a trustworthy and complete book of reference upon the archipelago. Those personally acquainted with the country and the wonderful amount of work done in it by the Jesuits were not without hope that something of this nature might be looked for from them. This hope has, in one sense, been fulfilled in the volumes now before us.

The book, as we learn from the introduction, is a direct outcome of the war. Hostilities had not been long in progress before the greater part of the missionaries were compelled to take to flight, and it was during the long period of waiting in Manila, while return to their cures was impossible, that the plan was conceived of compiling the work and publishing it contemporaneously with the new atlas of the archipelago, which for some months previously had been in course of preparation in the Observatory of Manila, under the able direction of P. Jose Algué, S.J., the head of that institute. The fall of Spain seemed likely to postpone all chances of publication, but the Philippine Commission came to the rescue, and the title-page bears the name of the Washington press.

The work, which is in two most cumbrous volumes, the first of which alone weighs some 9½ lbs., aims at being both a presentment of what was previously known concerning the archipelago, and also the first-hand knowledge and observation of various members of the Society of Jesus. An unsatisfactory feature about it, however, is that it is by no means easy to discover in every case whether the information is to be ascribed to the former or the latter source, and the references given are both scanty and incomplete. A section on the general geography of the group opens the first volume, each island and district being taken in order and dealt with under the heads of population, inhabitants, villages, language, productions, means of communication, and so on, and a good deal of original information is doubtless included in these 150 pages, drawn from the actual knowledge or research of the Jesuit personally familiar with the district. Much, however, is undoubtedly due to the *Guia Oficial*, and even more, perhaps, to F. X. Baranera's *Geografia de Filipinas*. The population still remains very uncertain, but the authors seem to think, working by ecclesiastical data, which are probably less in error than the lay estimates, that the "census" of 1891—which was, of course, largely guesswork—is not far wrong for the present day. This puts it, roughly, at about 8,000,000, and though there have been eight years for increase since that time, war and disease

* 'El Archipiélago Filipino: Colección de Datos Geográphicos . . . entresacados de anteriores Obras, ó obtenidos con la propia Observación y Estudio por Algunos Padres de la Misión de la Compañía de Jesús.' In two volumes, 4to. pp. 708 and 469 with Atlas fo. Washington: Imprenta del Gobierno. 1900.

have counterbalanced the latter. The American Commission officially adopted this figure, but it is noteworthy that it is nearly 2,000,000 higher than Réclus's estimate.

The chapter on ethnology is distinctly disappointing. There is, it is true, a useful map of the distribution of the different tribes, but a singular absence of the specialist's method characterizes the ninety pages devoted to this subject, and it is little more than a compilation from previous writers, though the Mindanao tribes are more carefully described, as might be expected, for this island was entirely given over to the ministration of the Jesuits. P. Joaquin Rajal holds the Bagobos and Manobos of Mindanao to be of the same race as the Hovas of Madagascar, and most of the Indonesians are regarded as having worked eastwards through Sulu to this island, just as in later times the Mohammedan "Moros" undoubtedly did. When these latter fierce people, at one time the terror and scourge of the archipelago as far north as Manila, really made their appearance is still uncertain. By some writers their advent is considered to date from quite an early period in the history of the faith, while others hold that it was not long anterior to that of Magellan. The Jesuits are of opinion that the Mamanuas, now confined to the northern part of the eastern cordillera of Mindanao, are the true autochthones of this island. The Manguianes of Masbate, Tablas, and Ticao islands are also held to be of Negrito stock. Bearing in mind the interest which has always been taken in the study of the numerous languages and dialects of the archipelago by the members of the society, it is disappointing to find only seventeen pages of generalities as the sum of the information afforded upon this subject.

Under the head of "Estado de Cultura" come, in rather incongruous juxtaposition, religion, agricultural questions, industries, trade, and public works, all of which are treated from a general point of view only, and are allotted about a score of pages each. The unsatisfactory state of present-day cultivation is vigorously condemned, as are also the indifference and laziness of the Filipino, which form perhaps the greatest difficulty with which America will have to contend, unless by a strange irony she finds herself throwing open the gates to Chinese labour. The land is of surprising fertility, but no development is possible without proper roads and railways. Of the latter, an elaborate scheme is already under consideration, but the torrential rains of many districts render both the construction and maintenance of these, and, indeed, even of ordinary roads, a most expensive matter. The introduction of new stock, proper machinery, new products, etc., is strongly counselled, together with the establishment of model farms and schools of agricultural instruction.

No history of the archipelago is attempted, the compilers confining themselves to a chronology of notable events from the period of Magellan's arrival in Cebu. This is followed by a chapter on the orography, and one on the hydrography of the islands, both being little more than extended lists of place-names. A somewhat elaborate section, however, deals with the thermal and mineral waters, giving the chemical composition of many of them, and the medical properties for which they are famous.

It is, however, in the natural history section, which brings the first volume to a conclusion, that the deficiencies of the work are most apparent. That the portion dealing with geology and mineralogy is of no great length is not surprising, for all that is thoroughly known in these branches of science is confined to a few localities in Luzon and the islands of Cebu and Panay. We shall have to wait till the railways with their jungle-clearing, cuttings, and tunnels have rendered the necessary assistance before much can be hoped for in this respect. But with botany and zoology it is a different matter altogether. Rich as are the fauna and flora of the archipelago, our knowledge of them is on the whole remarkably complete. Don

Sebastian Vidal, Mr. R. A. Rolfe, Mr. Burbidge, and others have done much in working out the botany; while Dr. Steere, Prof. Worcester, Mr. John Whitehead, and Mr. Everett have most thoroughly explored almost all the chief islands of the group in search of birds and mammals. Probably not less than eighty technical papers on the birds of the Philippines have been published during the last quarter-century, and it would be a matter of the greatest difficulty for a collector to discover a new species at the present time. That the compilers, however, are cognisant of the work that has been done by foreign naturalists, English, American, and German, does not anywhere appear. They make mention of Señor Vidal, and various lists of commercial plants and timber trees are given, together with a page or two on "plantas de adorno," in some or all of which his authority may be traced. But no attempt whatever is made at giving lists of the mammals, birds, etc., of the archipelago.

But though the first volume thus leaves much to be desired, not only in respect of the deficiencies we have named, but also, it may be added, in the clumsiness of its arrangement, the second volume may be cited as a remarkable example of the diligence and skill of the brethren of the Society of Jesus in their work at the far-famed observatory of Manila. To P. Federico Faura is due the honour of the latter's foundation. The fact was early recognized that the direction of the typhoons is almost invariably from the Pacific towards the Asiatic continent, and that the archipelago thus forms an advanced post, whence, in most instances, warning of the coming hurricane can with certainty be given. It was not possible at that time to utilize this knowledge, and Faura, after starting the observatory in 1865, had to be content with the records of his instruments in the capital. Recalled to Europe for some years, he returned in 1878, fired with the enthusiasm born of his visits to the most noted observatories. His first announcement of a typhoon was made on July 7, 1879, and he foretold its course. In 1880 was commenced the telegraphing of warnings to Hongkong. Four years later the observatory was recognized as official, and a service of fourteen secondary meteorological stations throughout Luzon was arranged. In 1890 co-operation with the Japanese central observatory at Tokio was effected. The records are now daily received from the secondary stations, and from the coasts of China and Japan, and the probable weather for the next twenty-four hours is telegraphed everywhere.

The second volume is rather intended for consultation than for reading, packed as it is with endless tables, diagrams, and seismographic tracings. After a description of the Manila observatory and its instruments, sections are devoted to barometric readings, temperature, hygrometry, rainfall, cloud conditions, typhoons, etc.; and it would appear that much, if not all, of this part is from the pen of the director of the observatory himself, P. José Algué. The astonishing differences in the rainfall in various localities, both as regards season and volume, are characteristic of the group. Even at Manila, where it would seem to be not unusually inconstant, considerable variation exists. Thus in 1867 121 inches were recorded, and in 1885 only 36.

Considerable space, as might be expected, is devoted to the subject of typhoons. In the nineteen years from 1880 to 1898 inclusive, no less than 397 visited the islands. The greatest number recorded in any one year was 28, and the fewest 11, the average being slightly under 21. No typhoon has been known to occur in February, and the first four months are generally exempt. July, August, and September are the three worst months, the last especially, the nineteen years showing a total of 79 for that month, or a yearly average of 4·2. Père Algué gives maps of what he terms the eleven principal types of typhoons, the classification being founded on their point of origin and their course.

Under American rule a project is in hand for the establishment of an extended network of observatories. There are to be nine meteorologico-seismic stations of the first class, at Aparri, Cape Bolinao, Daet, Albay, Tacloban, Cebu, Bacolod, Iloilo, and Zamboanga; twenty-eight of the second class, and sixteen of the third, with thirty-seven pluviometric stations. Daily records are to be interchanged with twenty-six foreign stations extending all along the coast-line of the Asiatic continent from Saigon to Tokio, and from as many of the Pacific islands as can be arranged. Already daily communication is established with eighteen of these foreign stations.

The archipelago being no less scourged by earthquakes than by typhoons, seismic observations form a most important part of the work of the Jesuits both in Manila and elsewhere, and a great part of the second volume is devoted to their record. Ten great earthquake foci are recognized, and Luzon and Mindanao are shown to be the most affected, all the foci, with one exception, being situated in these two islands. In Negros, Cebu, and Bohol earthquakes are rare, and they are unknown in Palawan; another proof, if any were needed in addition to the overwhelming zoological evidence, that this latter island properly forms part of the Bornean system, and is only politically Philippine.

The volumes abound in illustrations, for the most part reproduced by process from photographs. We recognize several of Dr. Bourn's plates, but no acknowledgment is made of them. Among them is one entitled "Bullock wallowing," which is none other than the tamarao (*Probubalus Mindorensis*), the remarkable anoa-like animal, peculiar to Mindoro, which was first obtained by the Steere expedition. The paucity of native types is to be regretted. On the whole the work fails to satisfy either the general or the scientific reader. The former is unlikely to attempt the assimilation of its twelve hundred pages, while many branches of scientific knowledge are so incompletely treated as to render it most disappointing to the latter. There is, moreover, no index, and the difficulty which besets the reader desirous of finding a reference is very great. At the same time the mass of data afforded, especially in the second volume, is not only important and useful, but also, so far as we are aware, for the most part unattainable elsewhere, and the work is therefore one which the student of this important region cannot afford to ignore. The accompanying atlas comprises twenty-five good topographic maps of the islands, and five others, among which the seismic and ethnographic are the most noteworthy. The index is ample, but the reader in search of a place has to be content with the number of the map on which it figures, and is afforded no further aid to its discovery. F. H. H. G.

AMERICA.

Central America and West Indies.*

This volume appears at a psychological moment, when general attention is attracted to the movement of the United States towards the West Indian islands and Panamá; therefore the well-classified data, physical, geographical, descriptive, biological, and historical, with which it abounds is of special interest to the world. Its value is enhanced by numerous illustrations; but more especially by ten artistic

* Stanford's 'Compendium of Geography and Travel' (new series), Central and South America, vol. ii., Central America and West Indies. By A. H. Keane, F.R.G.S. Edited by Sir Clements Markham, K.C.B., F.R.S. London: Stanford. 1901.

and carefully executed maps of the countries under consideration. Mr. Keane says, "The Greater and Lesser Antilles, which describe a somewhat undulating curve of over 1000 miles between Yucatan and Venezuela, are composed, to a large extent, of sedimentary rocks which have been subjected to much folding and dislocation. It is thus obvious that they represent the crests and summits of one or more continuous mountain chains, which are now, in great measure, submerged beneath the Atlantic waters, but at one time presented an unbroken isthmian bridge between Florida and Venezula—that is, between the Northern and Southern Continents." A bathymetrical map of the Atlantic ocean accentuates this quotation, and shows the long curved line of the Windward and Leeward islands resting on a submerged plateau which forms the base of Puerto Rico, Haiti, and Cuba, and then, under the name of the Bahama banks, stretches north-west almost to a union with Florida. From this peninsula, it is cut off by the deep submarine gorge called the Straits of Florida, through which the Gulf Stream finds its way at a pace of from 2 to 6 miles an hour; so that, as the author says, having in mind the great archipelago which once extended from Panamá to Mexico, "if the Northern and Southern Continents were formerly separated in the west, where they are now united, they may well have formed continuous land in the east." Subterranean agencies have been unusually active in the region bounded on the south-west by the Central American States, and on the north-east by this long submarine isthmus. In it are found the "Mexico Basin," much of it having a depth of 2000 fathoms; the "Bartlett Deep," lying between Cuba and Yucatan and showing soundings up to 2500 and even 2800 fathoms; and the great "Caribbean Basin," averaging about 2400 fathoms deep, and at times descending to 2800 below sea-level. If all of these could be drained, there would be three vast valleys margined continuously by a lofty mountain chain about 10,000 miles long, rivalling in unbroken elevation the Cordillera of the Andes, the grand northern sentinel of which, the dome of Santa Marta, would, overlooking the largest valley, tower 35,000 feet from base to summit. Such would be the appearance of this large area of the globe to which Mr. Keane calls our attention. To its main lands and islands, including Mexico and the three Guayanas, he assigns a population of 22,547,350.

As to the area of Mexico, under Spanish rule, in contact with the undefined French colonial possession of Louisiana, Mr. Keane remarks, "What Louisiana meant nobody quite knew; and in the opinion of some international jurists, the expression covered everything between the south-eastern states" (of the United States) "and the Rio Grande del Norte."

Louisiana in Spanish colonial days was certainly a vague expression, with debatable frontiers as between Spain and France. When the territory was transferred to the United States its boundaries seem to have settled themselves, although even up to 1819 the United States claimed that the area included in the Louisiana purchase extended to the Rio Grande, and included the whole of the province of Texas, then under the government of Mexico. A short digression regarding Mexico and Louisiana may be pardoned. When La Salle, on the bank of the Mississippi river, (which he named the Colbert), took possession of the region in the name of Louis XIV., he did not include the present state of Texas; nor does the old map of Franquelin, 1684, claim anything south-west of the Mississippi, although it includes all the area east of that stream lying between the Ohio river and the great lakes. When France ceded Louisiana to Spain, November 3, 1762, no definite boundaries were fixed; and they were equally undetermined when Spain, about three months later, under the treaty of Paris, ceded to Great Britain the whole of Florida, including all the possessions of Spain in North America, lying east or south-east of the Mississippi, these being an undefined part of Louisiana. Twenty years later, we find Great

Britain, in 1783, re-ceding Florida (east and west) to Spain in exchange for the Bahamas. Again the political kaleidoscope revolves, and, under the treaty of San Ildefonso (1800), Spain retrocedes to France the territory of Louisiana, creating a somewhat bitter feeling in the United States, to be followed, however, by an offer from Napoleon, in 1802, to sell the territory to that country, which was done, in 1803, for $15,000,000. The purchase comprised all of the present states of Louisiana, Arkansas, Missouri, Iowa, the part of Minnesota lying west of the Mississippi river, all of the Indian territory, part of Oklahoma, nearly the whole of Kansas, all of Nebraska, all of South Dakota and North Dakota, the larger parts of Colorado and Wyoming, and nearly the whole of Montana—the total covering an area of 883,072 square miles. This excludes anything east of the Mississippi river, which once formed part of Louisiana, and which, by other treaties, had been comprised in the Florida cession. No part of the west slope of the Rocky mountains was included in Louisiana. The claim that it extended to the Rio Grande del Norte was strenuously disputed by Spain, and afterwards by Mexico, until Texas fought for and gained its independence, and was, seven years later, admitted into the American Union.

To return to our author. In Mexico he calls attention to the vast central tableland which, "with a gradual incline from the city of Mexico, 7350 feet above sea-level, stretches 1225 miles northward to El Paso, 3718 feet elevation. It is bounded on the one side by the *Sierra Madre Oriental*, and on the other by the *Sierra Madre Occidental.*" But the former can scarcely be classified as a continuous mountain range; the country lying to the east of the one cordillera of Mexico, the "Occidental," presents here and there short isolated ridges, low mountain masses, and occasionally lofty hills. The long, smooth, gentle slopes of these and the vast valleys which lie among them, frequently hundreds of square miles in area, have often filled the writer of this review with reverential wonder at the lavish scale on which nature has hollowed them in all their sweeping immensity.

Ethnology occupies much space in Mr. Keane's book, and the origin, progress, and movements of Mexican races throughout Mexico, Central America, and the West Indies are treated with great skill and abundant knowledge of the subject. "In the north ruined cities are not numerous, and all the most imposing monuments, such as the pyramids of Cholula and Teotihuacan, are referred, by the Aztecs themselves, to their Toltec precursors, that is, as seen, to the Huaxtecan or northern section of the Maya-Quiché race. In the south, on the contrary, the whole land is thickly strewn with monumental remains—nearly seventy 'ruined cities' have already been described in Yucatan and neighbouring states, each stamped with a certain individuality beneath a generally uniform character, and all far more imposing than anything that can be traced directly to the Nahuas on the Anahuan plateau."

Mr. Keane mentions the last effort of the Central American States to form a union, which, however, was never carried into practical effect, and was dissolved in 1898. Nothing but a few thousand miles of railway and telegraph-lines could politically group these fragments of old Spanish colonies into a confederacy, having sufficient cohesive strength to command respect and obedience to law from each of its members.

Cuba, Puerto Rico, Hispaniola, and Jamaica are reviewed with a comprehensive description of their physical features, fringing reefs, uplands, plains, rivers, climate, flora, material and social conditions, and an outline of their stormy history. This is followed by a general survey of the Lesser Antilles, including the Bahamas, Bermudas, the Virgin islands and Santa Cruz, the Caribbee islands, and the outlying British Antilles.

Regret may be expressed that the industrial data and the commercial and financial statistics regarding all of these countries are not of more recent date.

In the concluding chapter the author finds himself at his best, and gives us an especially valuable description of the Guayanas, which, before the advent of the whites, were "little other than a geographical expression, with numerous variants of the name Guiana diffused over the whole region between the great bend of the Orinoco and the lower Amazon." It was "an ethnical word borne by a multitude of tribal groups belonging, either fundamentally or by assimilation, to the wide-spread Carib stock." Guayana embraces a vast region, which, owing to the connecting link between the Amazon and Orinoco, called the Cassiquiare canal, is known as the "Island of Guiana" (or Guayana), shared by Venezuela, Brazil, England, France, and Holland. "Out of this boundless domain was carved, in the per-fervid imagination of Sir Walter Raleigh, the 'Empire of Guaya,' whither his successor, Keymis, went in search of the fabulous Lake Manoa, where was a city 'the largest in the world,' in which dwelt the equally fabulous El Dorado." Had Keymis ascended the Essequibo instead of the Oyapok, "he might have reached a district about the low divide between that river and the Rio Branco," affluent of the Negro branch of the Amazon, "which has by some authorities been identified with the legendary Lake Parima, where dwelt the 'Man of Gold.' Here is the little Lake Amucu which, during inundations, communicates with both basins."

The coast-line of the Guayanas is nearly everywhere the same, but few feet above high water, a mangrove swamp in front, a morass behind extending inland about 20 miles, and constantly being raised "into an exceedingly rich alluvial belt which constitutes the only cultivated, and almost the only inhabited, part of the Guianas." Further inland is an old, elevated marine beach; and still penetrating the country, it rises in densely forested terraces, with occasional open savannas, until the low mountain ranges which divide the Atlantic slope from the Brazilian Guayana are reached, forming the water-parting between the northern and Amazon drainage; "but the seaward slope, lying between the savannas and the old marine beach, and comprising probably five-sixths of the entire area, is still uniformly covered with primeval forests, broken only by the narrow river-valleys and their numerous affluents ramifying in all directions." It is a roadless, uninhabitable, and almost intransitable region, except by painful canoe-navigation on the numerous rivers, which are broken by numberless rapids and cataracts.

Many countries, islands, and groups of islands have in this work come within the scope of the author's tireless powers of research and analysis, and it is only just to say that he has admirably acquitted himself of his arduous task by producing a 'Compendium of Geography' difficult to equal.

George Earl Church.

Harrisse's Newfoundland.*

In this volume M. Harrisse continues his work, a work which some have well compared to chemical analysis—employed to force from the material of geographical history, within a given period, every secret of the inner meaning concealed within it. There are times, however, when it may be questioned whether the eminent scholar's forcing process is not too forcible, and whether we do not occasionally

* 'Découverte et Evolution Cartographique de Terre Neuve et des Pays circonvoisins 1497–1501–1769. Essais de Géographie historique et documentaire.' Par H. Harrisse. Paris: Welter, 1900.

receive therefrom something of dogmatic hypothesis, of arbitrary assertion or negation, as well as of hidden truth.

It is impossible, within the limits of a brief notice, to discuss the many and thorny controversial questions raised and settled by M. Harrisse with so much decision and appearance of finality in these *Essais*. The first necessity is to give some account of the questions themselves. Even where one can least agree with M. Harrisse (whose views, it must be remembered, have frequently undergone modification), his treatment will be found worthy of the closest attention. In an introduction of seventy-two pages, the author passes in review the early North American enterprises and conceptions of the English (ii.–xxi.); of the Portuguese (xxi.–xxx.); of the French, and especially the Breton, Norman, Rochellese, and other adventurers and designers (xxx.–liv.); of the Spaniards (liv.–lviii.); of the Basques (lviii.–lxv.); of the Netherlanders (lxv.–lxix.); and lastly of the Italians;—all so far, and so far only, as Newfoundland and the adjoining coasts are concerned. The body of the work is divided in two main sections: first, from Juan de la Cosa to Gaspar Viegas, 1500–1534 (pp. 1–131); second, from Jacques Cartier to James Cook, 1534–1769 (pp. 135–366). Finally, the results of the foregoing inquiries are summarized in ten pages (367–376) of a hundred and forty suggestive and often startling aphorisms. When all deductions have been made, it must be admitted that a number of interesting and valuable points have been elucidated, among which the following are perhaps the best supported and the most worth notice. First, from 1498 the discoverers of the new world, dissatisfied with the 'Asiatic' theory, began to prefer the idea of an absolutely new land, totally detached from Asia. Columbus himself inclined to this view before the end of his life, but many who had adopted truer notions soon fell back, for a time at least, into the old 'Asiatic' bondage, Portuguese and Dieppese cartographers and mariners being the chief exceptions to this reaction. Nothing has been more ably and minutely worked out here than this matter, so long neglected or misrepresented. The close maritime connections of Portuguese and Norman enterprise are shown by the fact that, at the commencement of the sixteenth century, the ports of Normandy and Brittany employed Lusitanian pilots for their ventures to Brazil and the Indies. Secondly, we are told, no one can fix where John Cabot sighted or coasted the North American shorelands in 1497 or 1498, but it is probable that the landfall of '97 was made at a point comparatively southern, that his subsequent exploration was from west to east, and that on his way he passed Cape Race. Here is a complete, and in some respects unconvincing, change from M. Harrisse's earlier position. His Labrador landfall has been shown to be untenable; now he appears to run into another false extreme. Thirdly, John Cabot gave Pedro de Ayala a map which was practically identical with the North America of La Cosa's chart of 1500. Fourthly, England, throughout the earlier sixteenth century, being profoundly disappointed with the results achieved by Cabot, Fernandez, Gonzales, etc. (1497–1503), made no attempt after effective sovereignty in North America, took scarcely any interest therein, and allowed other nations to pre-occupy the ground. Thus no English map of North America in the sixteenth century shows anything but borrowed work, except for the arctic regions. The central part of Canada in, *e.g.*, Hakluyt's map of 1599, is borrowed from the chart drawn by Jacques Noel from Jacques Cartier's observations. Original English cartography of Newfoundland (signifying the Codfish Country in general, and comprising Labrador, Nova Scotia, etc.) only begins with Henry Southwood in 1675; English rights in North America, as derived from Cabot, Thorne, Elliott, etc., were first asserted by Dr. John Dee in 1578–80. Fifthly, the first European whose presence at Newfoundland is attested by documents was Gaspar Cortereal

(in 1500), from whose pilots were derived the earliest trustworthy elements for the cartography of these regions, as they appear in the Cantino map of 1502. Sixthly, the early expeditions to Labrador, down to 1541, were mostly due to the Portuguese; those to the neighbourhood of Cape Breton and Cape Race to the Bretons and Normans; while Portuguese and Dieppese cartography, from which Sebastian Cabot plagiarizes the Canadian section of his 1544 map, is the most valuable guide for tracing the growth of European knowledge of these regions; thus it is in the Nicholas Desliens of 1541 that the isle of Newfoundland first appears completely separated from Labrador, just as it is in the French explorations of Lieut. de Courcelle in 1675 that the above-named isle is first properly surveyed and laid down. In the third of these contentions, as to the—after all, conjectural—identity of La Cosa's indications with Cabot's own charts or notes, the author is surely too sweeping and too positive; in the fourth, fifth, and sixth he appears to have established his case with admirable thoroughness.

C. R. B.

GENERAL.

The Relations of Geography and History.*

This book is opportune, for the remarkable revival of interest in the study and teaching of geography as an introduction to the study and teaching of history has prepared the scholastic public to welcome treatises which bring out the connection of the two subjects in an intelligent way, illustrating it by numerous instances. That they are intimately connected is of course a very old idea. One finds it in Herodotus, as indeed one finds most things, for that most precious of all our ancient authorities was not more a historian than a geographer. But it is strange that so few writers, either in ancient or in modern times and down till about sixty or fifty years ago, should have given due emphasis to the relation of the two subjects, or dealt with that relation in a systematic and philosophic way. Hume, Gibbon, and Robertson, for instance, and still later, Hallam and Guizot, Macaulay, Ranke, and Giesebrecht, scarcely advert to it.

Mr. George has produced a useful little book, clearly written, and planned on a scale which makes it suitable for educational purposes. The first six chapters are general. The seventh deals with sea-power in peace and war, the eighth with geography in war. The rest contain illustrations of the general principles, given in the form of a treatment of different regions—viz. Europe, the British Isles, France, the Spanish peninsula, Italy, the Alpine passes (a topic which the author's long experience as an alpine-climber makes familiar to him), the Rhine-land, the Baltic region, the Danube basin, theatres of European war, the Mediterranean basin, and America. Most of these are well-handled, though some in rather too sketchy a fashion; but the chapter on America is scanty and weak. While usually sensible and judicious in his generalizations, Mr. George falls into a number of small mistakes, some of which it is well to adduce, that he may correct them in a future edition. He ascribes the Mohammedan use of the name "Frank" to designate Europeans to the time of the first Crusade (p. 58): it is really at least as old as the time of Luitprand. In asking why Moscow should have become a capital (p. 46), he omits all reference to the Kremlin hill. He says (p. 45) that "none of the various Persian capitals exist as towns," but Ctesiphon is practically represented by Bagdad. In referring to artificial capitals, he omits the remarkable case of

* 'The Relations of Geography and History.' By the Rev. H. B. George, M.A., Fellow of New College, Oxford. Oxford: at the Clarendon Press. 1901.

Ottawa. His remarks on the Khaibar pass (p. 26) are, if not erroneous, capable of being misunderstood; and he speaks as if the Khaibar and the Bolan were practically the only passes in that region, omitting the Gomul and the line of the Sind Pishin railway. He seems not to be aware that that railway, which he does not mention, has virtually superseded the Bolan line. He refers several times to the Carpathians as if they were a true and persistent mountain range like the Pyrenees, which they are not, being, indeed, to some extent a fiction of the map-makers. He says "there is nothing in favour of Madrid except its central position" (p. 49), without giving the reason why Charles V. made it his residence. "Spain, having no land frontier except France, is more likely to be permeated by French influence than any other" (p. 69). Nowhere, however, are the French so much disliked as in Spain; and the Pyrenees are practically a barrier to all land communication. The influence of France on Spain is chiefly due to the presence of many Spaniards in Paris. "The Phœnicians and the Jews dwelt side by side on the same coast, but they made very different uses of their opportunities" (p. 76). The Jews, during the flourishing period of the Phœnicians, really dwelt very little along the coast, being separated therefrom by Canaanite tribes. It is a serious over-statement to say (p. 155) "no physical frontier of more than a nominal character separates the region of the Garonne from the region of the Loire." An interesting passage (p. 150) points out the strategical importance, due to physical causes, of the region round Stirling in Scotland; but among the battles noted that of Sheriffmurie is strangely omitted, nor is there any reference to the great Roman military station at Ardoch. "The very title of kingdom of Italy is barely forty years old" (p. 192), but it ought to have been mentioned that there was a well-recognized "kingdom of Italy" in the earlier Middle Ages. It can hardly be said that "in the dominions still left to the Sultan the majority of the inhabitants are probably Greek" (p. 279), for the Greeks are not much more than a coast-fringe; neither is it true that "the Bulgarian people had been utterly swamped in the multitude of their Slav subjects" (p. 278); nor are the Bulgarians "probably a Turkish race," they are more probably Finnish; nor is it the fact that "with the exception of Marseilles, Greek settlements did not extend beyond Naples" (p. 281), for the colonies of Marseilles, such as Antipolis and Nicæa (Antibes and Nice), ought to have been mentioned, and Strabo tells us that Saguntum was originally a colony of Zacynthus. It is no longer true, since 1890, "that the whole of the population of the United States, save for the Irish element, is substantially Teutonic" (p. 284), for there has been a large Polish, Russian, and Czech immigration; nor is it quite correct to say that "the Alleghanies sink away into the plain at either end" (p. 284). A more serious error is the statement (p. 283) that "there have happily been no wars upon the frontier between Canada and the United States." And it is odd that in the chapters on mountains in connection with war, hardly anything is said of the important part played by gorges in the lower parts of mountains, *e.g.*, of the defile of Bard, in Napoleon's expedition across the Great St. Bernard.

The mention, however, of these and some other similar errors or omissions, must not prevent us from recognizing the general merits of the book. Its style is lucid and agreeable. It rectifies a good many current misconceptions. It contains many useful and pertinent remarks, such as those which point out how often political causes have, so to speak, overruled natural ones, and made the frontiers of states depart from the lines geography would have prescribed. Take it all in all, it may be recommended as a book fit to be used in colleges and the higher classes of schools, and one which any one who cares for history may read with profit and pleasure.

James Bryce.

EDUCATION.

Dryer's Physical Geography.*

This is the fourth new text-book on Physical Geography which has recently appeared in the United States. Like the others, it is suited for the higher classes of secondary schools, for pupil-teachers, and for the upper classes in evening schools. While the book is not so original as that by Profs. Davis and Snyder, it embodies most of the results of recent American research, and has the great merit of being arranged, on the whole, from an educational rather than from a purely logical point of view, so that the student passes naturally from one chapter to another. While we agree that the dynamics and morphology (or briefly the physiography) of the land can be taught effectively before that of the seas or of the atmosphere, we have grave doubts about the advisability of treating that of the sea before that of the air. We have no doubt, however, about the excellence of Prof. Dryer's method of beginning the treatment of each new chapter with a general description of the phenomena which are to be explained in it. The so-called realistic exercises are also, as a rule, very happily devised. The sketch-maps, distribution maps, and the other illustrations are numerous and well chosen, although acknowledgments to the sources from which the maps are taken are not given in every case.

The study of the land is begun by a consideration of erosion in general, which is immediately followed by three chapters on the Mississippi, Colorado, and St. Lawrence river systems, in which most of the river features the teacher wishes to emphasize are discussed. These three chapters and Chapter X., on the Drift Sheet of North America, are excellent examples of conveying physiographical and geographical instruction simultaneously.

This is one out of many examples of the art of the skilled teacher which are to be found in the book, which we cordially commend to teachers in this country who will appreciate its good points and profit by its fresh methods of treatment and fresh illustrations.

A. J. H.

THE MONTHLY RECORD.

THE SOCIETY.

The Annual Awards.—The annual awards of the Society have been made as follows for 1902: The Founder's Medal to Brigadier-General Sir Frederick D. Lugard, for the persistent attention devoted by him to African geography, during his fourteen years' service in that continent, in countries very little known; the Patron's Medal to Major P. Molesworth Sykes, for his journeys in Persia extending over nine years, and for the support given by him to our native explorers, by both of which means our map-knowledge of Eastern Persia has been immensely improved; the newly-founded Victoria Medal to Mr. E. G. Ravenstein (the first recipient), for his efforts during forty years to introduce scientific method into the cartography of this country, and for his valuable researches on the geographical distribution of population,

* 'Lessons in Physical Geography.' By Charles R. Dryer, M.A., F.G.S.A. New York, etc. American Book Company. 1901.

the climate of tropical Africa, the history of geographical exploration, and other important subjects; the Murchison Grant to Mr. J. Stanley Gardiner, for his researches in Funafuti island, in the Pacific, and the Maldive islands, in the Indian ocean; the Gill Memorial to Mr. G. G. Chisholm, for the services rendered during twenty-five years to geographical education, and for his geographical investigations of various kinds; the Back Grant to Lieut. Amdrup, of the Danish navy, for his two voyages of exploration to the east coast of Greenland; and the Cuthbert Peek Grant to Mr. J. P. Thomson, founder of the Queensland branch of the R.G.S. of Australasia, for the services rendered, by his writings and in other ways, to the cause of geography in that state.

EUROPE.

Botanical Distribution in Ireland.—A laborious investigation of the distribution of the Irish flora has been carried out by Mr. R. S. Praeger, who has published the full results as a volume of the *Proceedings of the Royal Irish Academy* (Series iii. vol. vii.). The work was undertaken some six years ago, when the absence of detailed information concerning the distribution of plants in the island was brought to the notice of Mr. Praeger, who thereupon set himself the task of collecting exact data as to the distribution of plants by counties. In carrying this out he devoted five seasons to personal work in the field, obtaining also the co-operation of various other workers. The voluminous work now published is based on the new material so obtained, combined with previously existing information, and, though not laying claim to absolute completeness, forms a very full record of the distribution of Irish plants among the forty counties or portions of counties into which the author has divided the whole area. Consisting as it does largely of lists of plants with their localities, the work will be chiefly of value for purposes of reference, but the introductory chapters supply an instructive view of the general botanical features of Ireland and of plant distribution as affected by soil and climate. The work begins with a general sketch of the physical characters of the island, in which stress is laid on the predominance of Palæozoic rocks, and (in the north-east) Eocene volcanic outpourings; Mesozoic rocks, and the Tertiary sedimentary formations with their crumbling clays, light soils, and gravelly wastes, being almost entirely absent. The great central plain of carboniferous limestone, the calcareous character of which is shared by the overlying boulder-clay formed of its *débris*, is of much importance botanically, as are also the gravelly esker ridges—a remarkable feature of the central plain—and the bogs, which occupy 13·5 per cent. of the whole surface. The main topographic groups of the flora are laid down thus: (1) The typical plants of the south and west coasts belong to three remarkable groups—the first formed of plants which have their headquarters in the Pyrenees or along the Mediterranean shores, and which reach in Ireland a latitude higher than that which marks the limit of their range on the continent; the second, constituting a boreal, almost sub-arctic group, made up of plants whose home is in the northern United States and Canada; while the third consists of plants characteristic of alpine situations or higher latitudes in Great Britain. The presence of the two last is explained by the special climatic conditions which prevail along the west coast. (2) As might be supposed, the flora of the central plain is essentially calcicole, but is characterized also by marsh and bog plants which are cut off by the thick layers of peat from the calcareous sub-stratum. (3) The east coast flora differs from that

of the west both in the absence of the characteristic types above alluded to, and in the presence (especially in the south-east) of a number of plants of light soils, many of which, in the British isles, are essentially English. These features are due to climate as well as soil, the former being drier, with colder winters and warmer summers, than in the west. The flora of Ireland is thus especially characterized by the east and west contrast of its elements. Mr. Praeger also describes in more detail the special plants of calcareous regions, of the sea-coast, sandy and gravelly soils, bogs, marshes, rivers, and lakes, and calls attention to the profound influence which the operations of man have exercised on the flora.

ASIA.

A New Mountain Road from the Indus to the Kashmir Valley.—Major Bretherton, D.S.O., sends us an account of a journey undertaken by him last autumn for the purpose of exploring a more direct route between Chilas on the Indus and Bandipur on the Wular lake than the road in common use, *viâ* Ramghat and the Burzil pass (13,750 feet), which, though good, is very circuitous. Starting on September 21, with nine men and thirteen animals, as lightly loaded as possible, Major Bretherton marched on the first day 19 miles to Niat, the first 9 being along the good road leading to Abbottabad, the remainder on a rough country path which diverges from the road to the left. Apart from the shaky cantilever bridges, no particular obstacles were met with on this march. At Nias the party was joined by two Sepoy guides of the Chilas levies, but one of these declaring himself unwell, it was decided to proceed with one only, Major Bretherton's orderly stating confidently that he knew the way thoroughly. On September 21 the march was resumed towards the Fasat pass, the track passing several awkward places, and after three hours' plodding snow began to fall, soon obliterating the path. It presently developed into a regular blizzard, and to add to the difficulties the Sepoy guide bolted, while on arriving at an amphitheatre of deep snow, from which five separate ravines led up to the crest-line, the orderly confessed to uncertainty as to the way. The party had been already three and a half hours in snow reaching above the knees, and as it was impossible to see more than 20 or 30 yards, the men became dispirited. There was nothing for it but to examine each of the five ravines, and after two hours' searching, a break in the cloud revealed the way to the pass. At the top of a difficult slope a snow cornice, some 10 feet high, blocked the way, and it was necessary to cut a path on to the crest; but this was at last accomplished, and the animals led triumphantly over. The height of the pass is stated by Captain Beazeley, R.E., who has recently surveyed the ground, to be 15,200 feet. At 7.30 p.m., after more difficulties, camp was pitched on a bleak, uninhabited spot, near the head of the Barai ravine, all of the party suffering more or less from snow-blindness and swollen faces. On the 22nd the Barai pass (14,250 feet) was ascended by a steep snow-slope, down which one of the ponies was precipitated quite 1000 feet without material injury. A descent was made into the Kel valley, and a sheep-track found which led to a few huts at Mori. Here camp was pitched after a harassing march of 15 miles, 7 of them on snow. At 12½ miles down the valley from Mori, the Kishanganga river was struck (September 23), and ascended to the bridge leading over to the track up the Matsil ravine. Some dangerous places were passed, and the bridge, which hangs at a height of 55 feet over the torrent, with a span of 90 feet, proved a rickety structure, but was crossed in safety. The track up the Matsil ravine was most difficult for animals, but at 6.30 a halt for the night was made at a desolate grassy glade called Chhoti Dakki. On the 24th, Major Bretherton left the baggage and struck out for Bandipur, ascending the Matsil ravine past the village of the same name, and crossing the

ridge separating it from the Lolab valley in Kashmir, whence the Wular lake was reached by the road across the Nagmarg range. The total length of this day's march was 46 miles. Major Bretherton estimates the distance by the new route at 116 miles, as against 190 miles by the usual route. During the journey he noted minutely all the alterations necessary to convert the track into a practicable road for laden animals in case the authorities should consider such a course advisable. The difficulties experienced were partly due to the lateness of the season.

North-West Baluchistan.—In part ii. vol. xxxi. of the *Memoirs of the Geological Survey of India*, Mr. E. Vredenburg gives a description of the country between 28° 30′ and 30° N., and between 60° 30′ and 66° E. South of the Helmand river is a great desert plain, with a few irregularly scattered groups of hills of horizontal or slightly bent strata, succeeded in the southern half of the region in question by concentric ranges of mountains concave to the north. These ranges are highly folded and closely set in the west and east, and strike north-west in the west at Kóh-i-Malik-Siáh, and north-east in the east at Nushki. The intermediate ranges are separated by broad desert plains on the inner side, strewn with black pebbles where not invaded by sand-dunes, and probably indicating regions of subsidence; and the ranges reveal "scaly structure," thrust-planes, and overfolds, the thrust being towards the depressed areas, whether north or south of the mountains. The rocks are of the same age and composition in both the slightly disturbed desert and much contorted mountain areas, and consist of shales, sandstones, and limestones of Upper Cretaceous to Upper Eocene age, often containing an enormous proportion of volcanic material, and in addition granites, syenites, diorites, while some more basic dykes have been intruded not earlier than the Eocene. On the margin of the desert plains near the tall ranges Siwalik formations dip towards the ranges which they fringe. This is an area of inland drainage, with irregular and ill-defined basins, where water seldom reaches the sun-cracked alluvium of the old lake-bottoms (*hamuns*). After a rare shower the water runs for a few hours in parallel furrows, often of unequal depth, which disappear after 5 or 6 miles in the plain. These are not V-shaped, but shallow, flat-bottomed troughs with steep sides. Where rainfall is heavier, some ranges are cut through by narrow gorges (*tangi*), which may be the outlet of a comparatively large area within the mountains, but beyond the last ridge the waters distribute themselves over an alluvial fan. The talus of conglomerate formed by coalescent fans forms a skirt (*daman*) to the mountain, which may reach to very considerable heights. The daman is naturally variable in composition, and water is stored in the permeable coarser and less movable deposits, whence it is drawn by artificial underground channels (*kárêz* in Baluchistan, and *kanát* in Persia), and by sinking artesian wells to form oases (cf. Oldham, *Rec. Geol. Surv. Ind.*, xxv. (1892), pp. 36–53). When the rainfall is heavy enough, boulders are carried to the plain and form the stony deserts, or *dashts*. Only a few streams, *e.g.* the Lora, Mashkel, and Tahlab, are large enough to form a channel on the plain, and as a rule the water gathers into shallow pools, which, when they dry up, leave a light-coloured mud deposit called *pat*, the most barren parts of the desert where not irrigated. The hamuns are but pats writ large, *e.g.* the Lora Hamun. An unusually deep pool may form a perennial sheet of water called a *nawar*, whose banks are studded with tamarisks, beyond which is a cultivated oasis. "The depression in which are collected the waters of the Helmand basin affords an instructive illustration of the uncertain manner in which hydrographic basins are defined in a desert region. The waters of the Helmand and of several rivers flow into two shallow fresh-water lakes surrounded by a reedy swamp. Sometimes the lakes overflow into this marsh, and thus become united. The fertile plain of Seistán proper is but the delta of the Helmand,

and has been formed partly by the sediments carried by that river into a lake which formerly occupied the entire depression, and partly owing to the desiccation of the lake itself. The *hamuns* and marshes that still exist are separated in ordinary seasons by a low watershed from the southern and lowest part of the depression, which contains the Zirreh lake. Thus, in ordinary seasons the Gaud-i-Zirreh is the centre of a basin absolutely distinct from that of the Helmand, . . . but when the flood of the Helmand is exceptionally abundant, the water of the combined lakes of Seistán rises to the level of the low watershed, and flows through the channel of the Shelag river into the Gaud-i-Zirreh."

Distribution of Vertebrata in India and the Neighbouring Countries.—The Royal Society has recently published an important paper by Dr. W. T. Blanford on the subject of the distribution of vertebrate animals in India, Ceylon, and Burma (*Philosophical Transactions*, Series B, vol. 194, pp. 335–436, Map).* The author's object is to determine the natural divisions of the Indian Empire on the basis of our present knowledge of the vertebrata, and especially to ascertain the zoological relations between the Indian peninsula and the neighbouring countries. The plan adopted for the study has been to divide the whole country into nineteen tracts, distinguished by physical characters—such as rainfall, temperature, presence or absence of forests, and prevalence of hilly ground, and to construct tables showing the distribution of each genus of land or fresh-water vertebrates in the tracts. The preliminary subdivision of the whole area is the following: A. The Indo-Gangetic plain. B. The Indian peninsula. C. Ceylon. D. The Himalayas. E. Assam and Burma. A review of the fauna of the tracts leads, among others, to the following conclusions: I. The Punjab tract differs so greatly in its fauna from the Indian peninsula and from all countries to the eastward, that it cannot be regarded as part of the Indo-Malay or Oriental region. All genera met with in the Punjab tract and wanting further east, are either Holarctic forms or peculiar, but with Holarctic affinities. II. The Himalayas above forest range, together with such portions of Tibet as come within Indian political limits, belong to the Tibetan subregion of the Holarctic region. III. India proper from the base of the Himalayas to Cape Comorin, and from the Arabian sea and the eastern boundary of the Punjab tract to the Bay of Bengal and the hills forming the eastern limit of the Gangetic alluvium, should, with Ceylon, be regarded as a single subregion, which may be termed the Cisgangetic subregion. The Cisgangetic fauna differs from the Transgangetic more especially in the batrachians, of which half the genera are distinct in each. The difference between the Cisgangetic fauna and that inhabiting the rest of the Indo-Malay or Oriental region is shown to consist partly in the absence in the former of numerous Eastern types, and partly in the presence of two constituents besides the Oriental genera. One of these constituents consists of mammals, birds, and reptiles, having a direct relationship with Ethiopian and Holarctic genera, and with the Pliocene Siwalik fauna; it may be distinguished by the term Aryan. The other is composed of reptiles and batrachians, and may be termed the Dravidian element. This is pointed out as being probably the oldest part of the Cisgangetic fauna, and may have inhabited the country since India was connected by land with Madagascar and South Africa, across what is now the Indian ocean, in Mesozoic and early Cenozoic times. Another peculiarity of the Indian peninsula fauna is the presence of genera and species which are found on both sides of the Bay of Bengal, but not in the Himalayas or Northern India. IV. The forest area of the Himalayas belongs to the same subregion as Assam, Burma (except south

* Abstract in *Proc. Royal Society*, vol. lxvii., No. 441, pp. 484–492.

Tenasserim), Southern China, Tonkin, Siam, and Cambodia, to which the term Transgangetic may be applied. The fauna of the Himalayan forest area is partly Holarctic, partly Indo-Malay, and is remarkably poor, when compared with the Cisgangetic and Burmese faunas, in reptiles and batrachians. The Oriental element in the fauna is richly represented in the Eastern Himalayas, and gradually diminishes to the westward. These facts appear to be consistent with the theory that the Oriental constituent of the Himalayan fauna has migrated into the mountains from the eastward at a comparatively recent period. V. Southern Tenasserim agrees best in its vertebrata with the Malay peninsula, and should be included in the Malayan subregion of the Indo-Malay region. The author points out that many of the remarkable features in the distribution of Indian vertebrates may possibly have been due to the Glacial epoch.

Altitudes in Asiatic Russia.—Prince Kropotkin writes to us as follows on this subject: "The Russian Geographical Society has lately issued, in the *Memoirs for General Geography*, vol. xxxi. 2, a very useful work by Dr. Hikish, entitled 'Catalogue of Altitudes in Asiatic Russia and some Adjacent Portions of Asia,' on the basis of the data published down to 1894. There formerly existed only one catalogue of altitudes in Eastern Siberia and parts of Mongolia, which was compiled and calculated by myself in 1872, and contained altitudes of 870 different spots. Numerous barometrical observations have been made since, especially in Turkestan and Western Mongolia, but they remained scattered in the publications of the Geographical Society, as well as in different volumes of travel, both Russian and English. Suffice it to say that if we exclude from Dr. Hikish's catalogue those altitudes which were included in the former work, there remain over 9000 altitudes which are now catalogued for the first time, to which A. A. Tillo, who had begun editing this volume shortly before his death, added 1130 more, thus bringing the grand total to 11,629 separate determinations. It must be remembered, however, before making use of this catalogue, that the altitudes are given in it such as they were published by the different calculators, all of whom have taken widely different altitudes for the fundamental points of their respective catalogues. Thus the Kropotkin catalogue was based on the following fundamental altitudes: Irkutsk, 1285 feet (level of Angara, 1255); Nerchinsky Zavod, 2012; Krasnoyarsk, 408; Lena at Yakutsk, 214; Tikhono-Zadonsk mine, 2185 feet. However, the altitude of Irkutsk still remains unsettled, as it was thirty years ago. According to the great levelling which was made across Siberia, and the results of which were published in 1888 by W. Fuss, the altitudes of different spots at Irkutsk are 1484 and 1521 feet (this last for the Church of the Holy Cross), and the altitude of the Angara is 1470 feet. The same levelling gives 498 feet for Krasnoyarsk, and 450 feet for the level of the Yenisei at that town. Now, it has already been mentioned in the *Izvestia* of the Russian Geographical Society that a serious mistake has crept into the levelling between Krasnoyarsk and Irkutsk, and that, owing to it, the altitude of Irkutsk (1520 feet), as well as of the Angara at Irkutsk, is taken too high. Such an error seems the more probable, as the railway levelling between Krasnoyarsk and Irkutsk does not give for the capital of East Siberia so great an altitude, and, as has already been pointed out once in this *Journal*, the extremely great heights of the barometer which are sometimes observed in winter seem to point to an error in the same direction. In all probability, the altitude of Irkutsk—*and consequently of Lake Baikal*—is taken about 100 feet too high. It would be most desirable that this point should be definitely settled, the more so as the scientific value of the Catalogue, just now published by the Geographical Society, would be considerably increased, if the present uncertainty of from 100 to 200 feet in the altitude of Irkutsk—and of thousands of other spots

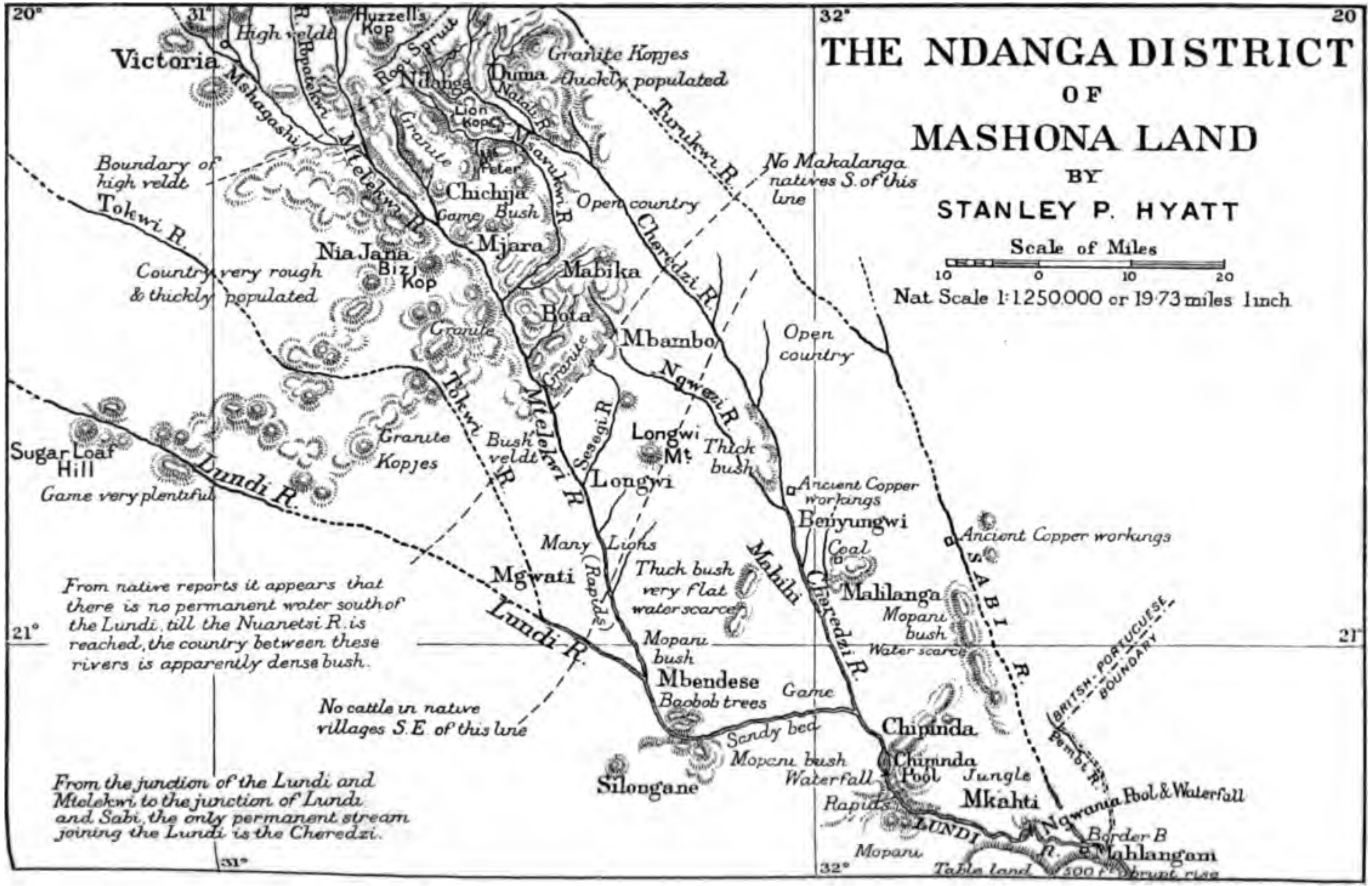
based upon the altitude of the East Siberian capital—were definitely removed before the original railway levellings have been forgotten or lost. Let us add that the catalogue is very well edited, and contains two most valuable alphabetical indexes, one of all the altitudes, and another of the authors."

The Narym Region.—The ninth volume of the statistical section of the *Memoirs* of the Russian Geographical Society contains a valuable paper, by A. Th. Plotnikoff, on the Narym region of the government of Tomsk, with a map. The work is chiefly ethnographical and statistical, and contains a detailed description of the inhabitants—Russians, Ostyaks, and Ostyak-Samoyedes—preceded by a good physical and geographical sketch of the country and an historical sketch of its conquest and colonization. The Narym region is a very interesting remnant of a sea which covered the lowlands of Western Siberia in Post-Pliocene times. It is a level plain, nearly 100,000 square miles in extent, the highest portion of which, the Vas'yugan tundra (30,000 square miles), barely rises 500 feet above sea-level. This last occupies the watershed between the Ob and the Irtysh, and represents an immense marsh, which, during the period of inundation by the rivers, becomes a vast lake, described by the inhabitants as "the Vas'yugan sea." In ordinary times this immense marsh is covered on its surface with a floating carpet, composed of decaying vegetable matter, clothed with grass in summer. Small knolls, called *tomars*, composed of decayed rough grasses and dry stems of wood, and covered with low growths of birch (seldom more than 1 or 2 feet high), rise amidst this floating carpet; they are also not rooted in the ground, but float on the surface of the marsh. Petrified wood—we are told—and horns (of reindeer?) are occasionally found in these knolls. The surface of the tundra is usually dry in summer; but as the carpet of vegetation floats over the surface of the marsh, water appears as soon as pressure is exerted upon the floating carpet, often under the pressure of man's foot. The Ostyaks cross it by laying three poles on its surface, and moving two of them at every four steps. Where the tundra is dry no such aids are necessary, but it is as difficult to march over it as over a sandy desert. Bears and reindeer find no difficulty in crossing the tundra, and yet the natives say that the bear occasionally finds difficulties, and in such case carries with him a piece of wood. Uninhabitable though such a territory may seem at first sight, it has nevertheless its inhabitants, who find their means of living in the immense forests, which supply furs and cedar-nuts, and in the rivers, which teem with fish. Evidently it is only along the courses of the rivers that the villages can be built, and yet we find in these inhospitable tracts nearly 5350 Russians—nearly all peasants—and about 3500 natives. The latter are, however, on the decrease, as they numbered 7500 in 1805. The work has a map on the scale of 27 miles to the inch.

A Journey across Sumatra.—It is stated in the *Deutsche Rundschau für Geographie* that a small military column under Major Van Daalen, while engaged in operations against the claimant to the throne of Acheh, has succeeded in crossing Sumatra through the almost unknown territory of the Gajus, a tribe which has in the past shown itself hostile to the Dutch authorities.

AFRICA.

The Ndanga District of Mashonaland.—Mr. Stanley P. Hyatt sends us the following account of the Ndanga district of Mashonaland, which stretches south-east from Fort Victoria, and includes the zone of broken picturesque country by which the dreary high veldt passes into the flat, waterless, and bush-covered plains which extend to the Portuguese border. This belt of mountainous country, which runs south-west towards the Crocodile river, has here a width of about 60


THE NDANGA DISTRICT
OF
MASHONA LAND
BY
STANLEY P. HYATT
Scale of Miles
10 0 10 20
Nat. Scale 1:1250,000 or 19·73 miles 1 inch
Victoria
High veldt
Huzzell's Kop
Mshagashi
Popatekwi R.
Roon Spruit
Ndanga
Duma
Natali R.
Lion Kop
Granite Kopjes
thickly populated
Turukwi R.
Mtelekwi R.
Granite
Mt. Peter
Msavukwi R.
Chichija
Game Bush
Open country
No Makalanga natives S. of this line
Boundary of high veldt
Tokwi R.
Nia Jana
Bizi Kop
Mjara
Cheredzi R.
Mabika
Country very rough & thickly populated
Bota
Mbambo
Granite
Open country
Ngwezi R.
Tokwi R.
Sesegi R.
Longwi Mt.
Thick bush
Granite Kopjes
Bush veldt
Longwi
Sugar Loaf Hill
Lundi R.
Game very plentiful
Ancient Copper workings
Benyungwi
Ancient Copper workings
Many Lions
Coal
Mahihi
Mgwati
(Rapids)
Thick bush very flat water scarce
Malilanga
SABI R.
From native reports it appears that there is no permanent water south of the Lundi, till the Nuanetsi R. is reached, the country between these rivers is apparently dense bush.
Mopani bush
Water scarce
Lundi R.
Mopani bush
Mbendese
Baobob trees
Game
BRITISH - PORTUGUESE BOUNDARY
No cattle in native villages S.E. of this line
Sandy bed
Chipinda
Mopani bush
Chipinda Pool
Waterfall
Jungle
Pembi R.
Silongane
Rapids
Mkahti
Nqwania Pool & Waterfall
LUNDI R.
Border B.
Mopani
Mahlangam
Table land
500 ft. abrupt rise
From the junction of the Lundi and Mtelekwi to the junction of Lundi and Sabi, the only permanent stream joining the Lundi is the Cheredzi.
20°
31°
32°
20
21°
21

miles, and ends abruptly with a drop of several hundred feet. Huge masses of granite are intersected by fertile valleys, traversed by streams of clear water, and all available land is either cultivated or used for grazing purposes by the natives, who are pure Makalanga. In the arid bush veldt the population consists of small communities of Mahlinga, scattered along the banks of the larger rivers, who, before the Zulu invasion early in the last century, occupied the whole country as far as the coast. The Makalanga grow large crops of "mpoko," a small red grain resembling rape-seed, and, in the lower parts of the kopje country, excellent tobacco. They possess considerable numbers of black cattle, small, but beautifully built, and very hardy. The Mahlinga grow comparatively small crops, and possess practically no cattle; but their sheep and goats are much superior to those of the Makalanga. Under the present settled *régime*, which has put a stop to the former raids of the Matabele and Mchangana Zulus, the Makalanga are increasing rapidly, and, though at present quiet and contented, may possibly give trouble in the future. Individuals with decided Semitic features are common among them, and, but for their dark skins, might be taken for Levantine Jews. This cast of face seems to be of the nature of an occasional reversion to the type of an alien ancestor. The customs and traditions, and especially the sacrificial rites of the Makalanga, are interesting, and their language differs from that of their neighbours in having no "click" sounds. The Mahlinga have copied the dress and customs of the Mchangana, and speak a kind of bastard Zulu. Their country seems to have been once invaded by the Portuguese, as traditions exist of a force of white men having been cut up by the natives between the Mtelekwi and Ngwezi rivers, long before the advent of the Zulus. In the mountainous country there are large belts of Mahobba-hobba trees, with straight trunks and soft but durable wood, used for building purposes; but otherwise the trees are stunted and of little value. Much of the surface is covered with bracken, which seems identical with the English species. In the bush country large areas are occupied by mopani trees, which often attain a large size. In the angle between the Sabi and Lundi rivers, the bush becomes a veritable jungle, with dense undergrowth. The ground here is stony, with practically no grass, but in some parts of the bush country there is a coarse grass, from which the natives extract salt by burning. Game of all sorts abounds in the bush country, including antelopes of many kinds, wild pig, elephants (in the neighbourhood of the Portuguese border), while lions, leopards, and hyænas give much trouble. Buffalo are practically extinct west of the Sabi. Huge fish are found in the pools of the Lundi, the so-called "barbel" sometimes scaling 60 lbs. In the dense bush near the Portuguese frontier, there is a species of guinea-fowl which is apparently unknown to naturalists. It is larger than the common variety, and the head is covered with a large crest of white feathers, while the skin of the face and neck is a brilliant red. The spots are very small, and of a bright metallic blue. Important discoveries of coal and copper have lately been made near the Cheredzi and Sabi rivers. The former occurs in a sandstone formation, and the outcrop is large, but of a poor quality, though improving at a slight depth. The copper has been extensively worked by the ancients, the workings taking the form of huge quarries, sometimes 500 feet in length.

Mountain Flora at the Cape.—Dr. R. Marloth, who a few years ago collected botanical specimens from some of the higher peaks in the south-west of Cape Colony, gives the results of his investigations in the *Transactions of the South African Philosophical Society* (vol. xi. part 3, 1901). In ascending the higher mountains, *e.g.* the Great Winterhoek, near Tulbagh, the last arborescent shrubs are passed at about 4000 feet, while higher up only low shrubs of heath, composites, *Bruniaceæ*, *Rutaceæ*, etc., cover the slopes, becoming gradually smaller

and more compact. It is only, however, when about 6000 feet is reached that types of alpine character appear, and of the comparatively few summits which exceed that height in the south-western district of the Cape Colony, few have yet been explored botanically. Dr. Marloth collected from five peaks above 6000 feet, securing seventy-two species, of which he enumerates the names, though these do not constitute the whole flora. He points out that, owing to the general xerophytic character of the plants at the Cape, and the consequent need of such differentiation as may guard them against excessive transpiration, one of the usual distinctions between the vegetation of higher and lower regions is wanting. The general composition of the higher flora is practically the same as that of the lower slopes and valleys. It includes a few species known from the plains below, a number of others known from the foot of the mountains, and some, *e.g.* *Erica sebana* and *Anemone capensis*, which are also found at or below the altitude of Table mountain, 3549 feet. In several cases, however, the specimens from the high regions represent distinct varieties, if not new species, and the characteristic stunted and cushionlike growth of alpine plants is often noticeable, whilo all plants with permanent foliage are thickly covered with hairs. It must be remembered, also, that our knowledge of this flora is still incomplete, and that a number of truly alpine types may yet be found.

Baron von Stein's Expedition in the Southern Kamerun.—This important expedition, of which some account was given in the February number of the *Journal*, has now been brought to a successful conclusion, and details of the return march, in great part by new routes, are given in the first three numbers of the *Kolonialblatt* for the present year, accompanied by an excellent map. The further results seem entirely to confirm Baron von Stein's statements as to the course of the Ja and the general geography of the region. A *détour* was made to the south for the purpose of visiting the Bule countries on the southern limb of the great bend of the Ja, of the identity of which with the Ngoko there seems now no doubt. Rapids were found, as previously reported, on this section of the river, and a fall of some 25 feet also heard of, but there are considerable stretches in which the river may prove useful as a means of communication. The country as a whole shows little variation of level, and even on the water-parting between the two sections of the Ja the highest point is only some 500 feet above the rest of the surface. Much progress has been made towards opening direct commercial relations with the coast, and the Nyem tribes show a desire to deal direct with the white men, their ivory and rubber being at present forwarded to the Batanga coast through the intervention of the Bule. From Bijum, in the Nyem country, Baron von Stein made a wide circuit to the north, reaching the important town of Bertua, reached by Dr. Pleyn on his last disastrous expedition. The route led across the source region of the Ja, Bumba (the other branch of the Ngoko), Nyong, and Dume, the last-named being an important branch of the Kadei or western head-stream of the Sanga, and valuable information as to the hydrography of the region was obtained, by which considerable alterations will be introduced on our maps. It was also found that the forest region extends further north than had been supposed. Baron von Stein's account contains much interesting information on the native tribes met with, as well as on the present and future possibilities of trade, which in the northern parts of the region is at present in the hands of the Hausas, whose influence is firmly established at Bertua. He recommends the introduction, as currency, of pieces of brass wire, such as are in use on the middle Congo. The numbers of French five-franc pieces imported has so depreciated the silver currency that the franc now stands at only one hundred, or at most two hundred, cowries in value.

Exploration in French Congo.—News has lately been received in France of the successful termination of a journey of exploration between the Sanga and Ubangi, undertaken in July last by M. Dessirier de Pauwel. The result of the journey is to extend the knowledge of the Bali, partially explored, as already announced in the *Journal*, by MM. Fredon and Cadenat. From the Bangi station M. de Pauwel went through the Bonjo country to the Lobai (of which the Bali is the upper course), afterwards proceeding north by that river to Carnot on the Sanga. The Lobai is said to be an important stream, and to have three upper branches in addition to the Bali.

Results of the German Pendulum Expedition in East Africa.—During the course of the German Expedition in East Africa under Lieut. Glauning and Dr. Kohlschütter, an outline of the work accomplished was from time to time given in the *Journal* from the preliminary reports of the travellers. A fuller account of the results of the expedition from a geographical point of view was last year given by Dr. Kohlschütter at the "Geographentag" at Breslau, and is now printed in the proceedings of the meeting (also issued separately as a reprint). The first part of the paper deals with the cartographical results, some of which have already been recorded in the *Mitteilungen aus den Deutschen Schutzgebieten*, and referred to in the *Journal*. The most important are those obtained by triangulation in the mountainous districts north of Lake Nyasa, especially on a line crossing the Ukinga mountains of the station of Nasaurua. Dr. Kohlschütter urges the importance of more accurate surveys, and alludes especially to the difficulty which exists of fitting together surveys of different districts in the absence of a knowledge of the varying deviations of the plumb-line from the vertical, which show considerable differences in short intervals. The most interesting part of the paper is, however, that dealing with the rift-valley systems of East Africa, the study of which, in relation to possible disturbances in the force of gravity in their neighbourhood, such as have been found to exist on the shores of the Red sea, formed the main task of the expedition. The observations have not yet been worked out sufficiently to allow a statement of results from this point of view, but the work of the expedition has thrown new light on many points connected with the morphology of the rift-valleys which are of much interest. Like Bornhardt, Dr. Kohlschütter shows that the Nyasa rift-valley bifurcates at the north end of the lake, but he points out also that there is an additional fault-scarp running parallel with Nyasa on the east of the Kinga mountains, and also that the north-western main branch —that of Lake Rukwa—leaves the Nyasa trough by two separate arms, separated by the uplands of Nyika, the more southerly of the two, which follows the line of the Songwe, Nkana, and Saisi valleys,* being defined on its south side by the northern escarpment of Mount Waller. Further north the Rukwa trough can be traced distinctly to its junction with that of Tanganyika (a fact already hinted at by Mr. Hore, though since denied by Mr. J. E. Moore), the apex of the Fipa plateau, which lies between the two rift-valleys, occurring at Karema. The Rukwa valley appears to be continued westward in the Lukuga gap on the west of Tanganyika, and has thus been intersected by the later subsidence of the latter. Rukwa must, therefore, like Tanganyika, have been occupied by a Jurassic sea, if Mr. Moore's theory is accepted, and Dr. Fülleborn has found indications that it too contained a special fauna. As regards the rift-valleys between Victoria Nyanza

* It was suggested in the *Journal* for 1896, in a review of Dr. Gregory's 'Great Rift-valley,' that the Nyasa trough might be continued north-west by the Songwe and Saisi valleys, though the idea was criticized at the time by a writer in the *Zanzibar Gazette*.

and the coast, several important facts were brought to light. It seems probable that the Nyarasi or Eyassi trough is continued eastward across the main rift-valley, while a parallel trough—that of Sale—seems to exist to the north, intersecting the main valley at the Natron lake. Both of these have their floors formed of horizontal deposits which give evidence of having been laid down in old salt-lakes. The main rift-valley is at a decidedly lower level than that of Nyarasi at the point of intersection, and it thus lays bare a section of the latter. Its comparatively recent origin receives fresh confirmation from the fact that its subsidence has carried with it the half of a volcano situated on the floor of the Sale trough.

AMERICA.

Forty-mile, Yukon Territory.—Mr. G. L. Gordon, headmaster of the St. James' Diocesan School at Forty-mile, Yukon Territory, sends us an account of that remote settlement lying almost on the arctic circle, and forming the most north-westerly settlement in the British Empire. The Forty-mile creek, on the delta of which the town stands, is well known as traversing some of the richest of the recently discovered gold-fields, but its site was frequented from about 1858 by the old fur-traders, who had here their "Fort McQueston." At present some 100 to 150 miners are working the bars in its vicinity, and make the town their depôt for supplies, while on an adjoining island is a settlement of fifty to sixty Indians under the Church Missionary Society. No very good character is given to them, as they are said to be superstitious, and when out of control of the missionaries addicted to drink, while stubbornness, pride, selfishness, and ingratitude are put down as prominent traits. Other tribes, known as "Tanarias," from the hills near which they live, have villages up the creeks, and are far more intelligent than the river people, and do a large trade in furs. Apart from gold the country's resources are slightly developed, though coal, copper, and other metals exist, and some coal is worked. At Coal creek, some 10 miles below Forty-mile, about 2000 tons were turned out during the last season. The agricultural resources are said to be sufficient, if developed, to supply twice or three times the present population of the country. Vegetables and cereals, as well as garden flowers, can be grown successfully, and Mr. Gordon sends details as to his own attempts at cultivation, which prove the luxuriance with which plants grow during the summer months. The fact that at 3½ feet below the surface the soil is permanently frozen is said to be rather advantageous than otherwise, as helping to retain the moisture during the long summer days with hot sun for twenty hours. Game is abundant and fresh meat plentiful, and the Yukon salmon are a great resource both to whites and Indians. Rats and mice are a plague, but with the recent introduction of cats (which have sold for $25 a piece) they have become scarcer. Horses and oxen are being brought in, and will soon supersede the dog as a beast of burden. The neighbourhood of Forty-mile has, owing to its sheltered position, cooler summers and warmer winters than many other parts of the country. From May to September the temperature varies between 70° and 90°, while in December, January, and February, anything from 10° to 58° below zero may be expected. From October to April there is little or no rain, and after November very little snow; but rain is generally abundant from April to August. The Yukon is not fully closed by ice till the middle of November, and breaks again about May 15, the break-up generally causing a flood somewhere along its course. In 1901 a dangerous flood occurred at Forty-mile for the first time for many years, and the sudden breaking of the ice is described as the grandest sight ever witnessed by the writer. Houses 20 feet above the river-bank (itself 25 feet above the ordinary water-level) were flooded, forcing the whole population to take refuge on a ridge outside the

town, and damage to the amount of £25,000 was done to the town. After this flood, frogs, which had before been unknown in the place, made their appearance for the first time. Forty-mile is the extreme post of the North-West mounted police, whose duties are very onerous, including all the custom-house and post-office work for the whole district. It is connected by telegraph with Dawson and with Eagle in Alaska, and since September last with British Columbia.

The Delaware Ship Canal.—The narrowness at its northern portion of the great tongue of land which separates Chesapeake bay from Delaware bay, and the existence on either side of it of such important cities as Baltimore and Philadelphia, are facts sufficiently striking to have drawn attention to the feasibility of a ship canal as far back as the beginning of the last century, and the subject has again been brought into notice by the recent introduction into Congress of a Bill asking for the appointment of a Commission to examine and report upon the various routes, and to authorize the construction of a ship canal at a cost not exceeding £2,000,000. It is anticipated that with a sea-level waterway capable of taking large vessels, and with a minimum depth of 30 feet, a great saving of time could be effected. The transit would probably take from fifteen to nineteen hours, but it is noticeable that the shipping community does not seem to regard the project very favourably, holding that with probable delays and the infliction of tolls and dues there will be little saving either in time or money.

POLAR REGIONS.

Danish Expedition to Greenland.—An expedition for the thorough study of the peoples of Greenland, their sociology, folklore, etc., has been organized in Denmark, and is to start for the scene of operations about the middle of June. The members of the expedition will be—Mr. Mylius Erichsen, a well-known writer, to whom the idea of the undertaking is principally due; Lieut. Count Harald Moltke, artist; and Mr. Knud Rasmussen, a native of Jacobshavn, in North Greenland, who has a thorough knowledge of the Eskimo language and will act as interpreter, besides undertaking a special investigation of the folklore and inner life of the natives. The expedition, which is the first that has been undertaken for the special objects in view, has the cordial support of the Danish State Commission for Greenland research, composed of Rear-Admiral Wandel, Dr. Steenstrup, and Commodore Holm, as well as of such arctic specialists as Dr. Nansen, Commodore Jensen, Captain Garde, Lieut. Amdrup, and others. Mr. Mylius Erichsen has for some time devoted himself to a study of existing literature on Greenland and its people, while Count Moltke has had former experience of Arctic travel with Dr. Steenstrup and Mr. Adam Paulsen. It is proposed eventually to publish the results in a fully illustrated narrative for the general public, together with special memoirs on the people and their mode of life. On arrival at Godthaab in July, it is proposed to coast northward to Jacobshavn, and there to winter, proceeding in dog-sledges at the beginning of the New Year to Upernivik and the Eskimo settlements at Cape York and on the shores of Smith sound. The expedition will probably occupy from eighteen months to two years.

The German Antarctic Expedition.—A letter from Dr. Enzensperger, one of the scientific observers on Kerguelen island in connection with the German Antarctic Expedition, is printed in the March number of *Petermanns Mitteilungen* and in the *Zeitschrift* of the Berlin Geographical Society. It is dated December 20 last, and gives an account of the voyage of the *Tanglin* from Sydney, and the landing of stores, etc., both for the *Gauss* and for the Kerguelen station, with the buildings for which considerable progress had been made at the time of writing, in spite of difficulties occasioned by stormy weather. Down to the departure of the *Tanglin* the *Gauss* had not arrived at Kerguelen, the telegram received from Australia early

in the present year referring only to the safety of the Kerguelen party; but news has now been received in Berlin that the ship reached the island on January 2, with all well on board, and left again for Termination island on the 31st. The late arrival of the *Gauss* is said to have interfered somewhat with the observations at Kerguelen, as she had on board some of the required instruments. The publication of the scientific results of the voyage, as contained in the reports sent home by Dr. von Drygalski and his staff, has already been commenced in Berlin.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Oscillation of the Terrestrial Pole.—It is well known that the axis of the Earth describes a circle, with a radius of about 23½° round the pole of the ecliptic in a period of about 26,000 years. This movement, called precession, was known to Hipparchus. Nutation was only discovered by Bradley in 1747. It is a kind of wobbling motion, similar to that produced in a spinning-top by a small piece of wax or other substance placed on the surface. Neither of these movements affects the geographical co-ordinates. There is, however, another variation that has been much discussed of late, by which the position of the axis of rotation relatively to the Earth's surface is changed, and the latest information about this movement is discussed by Dr. M. C. Engell, in the *Geografisk Tidskrift*, Bd. 16, Hefte 3 and 4. To illustrate its effects, Dr. Engell supposes the pole to be moved to Cape Cheliuskin. The latitudes on the meridian, through Cape Cheliuskin, will be diminished from the cape towards the present equator, and increased on the other side of the cape. On other meridians the differences will be less, and will vanish at the intersections of the old and new equators. The longitudes also will be changed—Spitsbergen, for instance, now in east longitude, will then be in west longitude. Bessel was the first to fully grasp the fact that the position of the axis with regard to the Earth's surface is not constant. In 1820–21 he estimated that the variation could not exceed 0·25″. Afterwards several observations were made with a view to solving the problem, and ten years ago many of the chief observatories of Europe and America co-operated in the work, with the result that the variation of the altitude of the pole was thoroughly demonstrated, and the maximum was recorded at Strasbourg and the minimum at Honolulu. Owing to different stars being chosen for observation, to the use of different instruments, etc., the results obtained could not be satisfactorily compared, and therefore it was resolved to establish a special department for the observation of the altitude of the pole. A mathematical analysis by Th. Albrecht showed that stations at an interval of 120° or 90° of longitude would be best adapted for the work, and finally the stations Mitsusava (Rikuku province, Japan), Ukiah (California), Gaithersburg (Maryland, 6 miles from Washington), and Carloforte (San Pietro island, Sardinia) were selected. The Russian station at Charjui, Central Asia, and the Cincinnati Observatory also took a share in the work. In December, 1899, all these stations were in full swing. An alt-azimuth instrument was used in order to determine the longitudes by Horrebow's method, and the records were sent to Potsdam, where all the material was worked up. Albrecht has calculated the variation, and given a graphic representation of it, which shows how very irregular the movement is. The maximum amounts only to about 0″·60, or about 65 feet on the Earth's surface, calculated from Bessel's spheroid. Stations are also to be established in Grahamstown, Gosford (30 miles from Sydney), and in Santiago, Chile, for observations in the southern hemisphere. Hardly anything is known of the causes of the phenomenon. It may be assumed that it is due to displacements of matter in the lithosphere, hydrosphere, or atmosphere, or in all three simultaneously. Seismographs indicate the existence of

movements in the Earth's crust, but these are scarcely sufficient to produce a perceptible movement of the globes. In the hydrosphere such displacements are on a larger scale, and Lamp has proved that a displacement of 2500 cub. miles (88,290 cub. feet) of water in the ocean, from 30° S. to 35° N. lat., will suffice to produce a difference of 0″·5 in the altitude of the pole at Berlin. Lamp believes that such a transference of water is actually brought about by means of ocean currents, and it certainly is probable that the summer heat may heap up the water in the northern hemisphere. Bakhuyzen holds that a connection can be proved between the sea-level in Holland and the polar variation. It has also been suggested that the unequal distribution of atmospheric pressure may produce movements. In that case the maximum displacement of the pole of inertia would be in the direction of the greatest alteration in the pressure, but such is not the case, and, therefore, atmospheric pressure is not the only cause.

GENERAL.

The Second Voyage of Vasco da Gama.—Two letters written by a certain Matteo da Bergamo, who accompanied the fleet of Vasco da Gama to India in the years 1502–1503, have been discovered in the library of St. Mark, and copies are published by Signor Prospero Peragallo in the bulletin of the Italian Geogr. Society, February, 1902. These letters were despatched from Mozambique on April 18, 1503, to Count Affaitati, for whom Matteo was agent, and Lopes states that on that date two vessels of the squadron sailed from Lisbon. Matteo reports that after leaving Melinde they came to a country called Abul, where a quantity of gum and a few diamonds were obtained, but otherwise his narrative is interesting only as confirming the accuracy of Lopes' account published in Ramusio's voyages.

The Oxford School of Geography.—The Report for the year 1901 states that the attendance of students during the Hilary, Easter, and Michaelmas terms was, respectively, 119, 36, and 93, the Easter term thus again showing a falling off as compared with the other two, but not to nearly the same extent as in 1900, when the number fell to 16. The number of students specializing in geography and availing themselves of laboratory instruction, besides attending most of the lectures, was, for the three terms respectively, 7, 4, and 6, as against 6, 4, and 5 in the previous year. The practical and tutorial instruction, from which especially valuable results are to be expected, has been, as in the former year, carried on regularly by Messrs. Herbertson and Dickson, the latter being assisted in the surveying class by Mr. Darbishire. The courses of lectures were as usual very comprehensive, dealing with various aspects of historical, economic, and physical geography. Much improvement has been effected in the equipment of the school, the sum of £210 having been expended on the most urgently needed additions to the plant, while the three rooms in the Old Ashmolean Building placed at the disposal of the school, have proved well adapted for the purpose. Presentations of 109 books, atlases, and pamphlets, and 209 sheets of maps have been made. A useful feature in the programme for 1902 is a vacation course, to extend from July 29 to August 19. It is intended primarily for teachers, and will be devoted to generalizations concerning the Earth as a whole, including a study of the figure and surface-forms of the Earth, the great trade-routes, the history of exploration, surveying, and map-making. An excursion to places of special geographical interest will be arranged at the conclusion of the course. The fee for the whole course is £2 2*s.*, and names of intending students are to be sent as soon as possible to the Curator, School of Geography, Old Ashmolean Building.

OBITUARY.

Cecil Rhodes.

THE position occupied by the late Mr. Cecil Rhodes during the past twenty years has been of so commanding a nature that there is probably no single department of South African affairs which has not felt the influence of his great personality to a greater or less degree during that period. This is certainly the case with the course of geographical progress since the deceased statesman first came to the front as a moving power in the destinies of British South Africa. Mr. Rhodes' vast schemes for the extension of British influence towards the heart of the continent have had so many points of relation with geographical facts and considerations that the important share which he undoubtedly took in the furtherance of geographical work is not to be wondered at. Although, when the British South Africa Company was founded in 1888, the period of pioneer exploration in South Africa, associated with such names as Livingstone, Moffat, Baines, Mauch, Selous, and others, was well-nigh over, a vast amount has since been done towards the detailed mapping of the southern interior, and of this the greater portion has had more or less connection with the extension of the political sway of the company, and it is to Mr. Rhodes, as the moving spirit of that body, that the credit for the work achieved must be largely assigned. Fourteen years ago large areas even to the south of the Zambezi were still most imperfectly known, and the pioneer workers for the company, whilst opening up, like Mr. Selous, routes for the advance of civilizing agencies into the heart of Mashonaland and Matabeleland, were at the same time supplying the first basis for an adequate map of those regions. Work of the same character has more recently been done for the remote regions north of the Zambezi, and it is to officials of the company, whose work in this direction always had the cordial support of Mr. Rhodes and his fellow-directors, that the extension of the bounds of knowledge has been chiefly due; while by the encouragement given to the great undertaking of the geodetic survey of South Africa, Mr. Rhodes and his associates have done their part to extend to the countries under their rule the benefits of more scientific survey.

It would be out of place here to attempt to recall even the leading events of Mr. Rhodes' active career, which has been fully dealt with in the public press of the country. Born at Bishop Stortford in 1853, he carried through the great achievements with which his name will ever be associated within the comparatively short lifetime of forty-nine years, during the last thirty-two of which he had been intimately connected with South Africa.

Sir Richard Temple.

By the death of the Right Honourable Sir Richard Temple, Bart., G.C.S.I., C.I.E., the Society loses one of the most distinguished of its Fellows. Sir Richard had been in failing health for some time before his death, which occurred on March 15, exactly a week after his seventy-sixth birthday. Born March 8, 1826, a descendant through his great-grandmother of the Temples of Stowe, Richard Temple was educated at Rugby and Haileybury, and entered the Bengal Civil Service in 1846. After serving under Thomason in the North-West Provinces, he became, in 1854, private secretary to John (afterwards Lord) Lawrence, then Chief Commissioner of Lahore. Illness enforced his absence from India during the Mutiny, but he was able to return to his duties towards the end of 1857. After serving in the Finance

Office under Mr. James Wilson and Mr. Samuel Laing, he filled in quick succession the important posts of Chief Commissioner of the Central Provinces, Resident at Hyderabad, Foreign Minister (1868), Chancellor of the Indian Exchequer (1868), Lieut.-Governor of Bengal (1874), and Governor-General of Bombay. In all these offices Sir Richard displayed the greatest energy and ability, and continually made extensive journeys through the vast districts under his charge and in other parts of India. Especially was he active in alleviating the distress caused by the terrible famines of 1874 and 1877, and it was for his work in organizing relief that he received his baronetcy in 1876. In 1880 he returned home, and devoted himself to a parliamentary career. Prior to his election to the House of Commons in 1885, he published several books descriptive of India and life in India. He remained in parliament until 1895, and from 1885 till 1888 was also vice-chairman of the London School Board, and till 1892 chairman of the Finance Committee of that body. In 1896 he became a member of the Privy Council.

Sir Richard was elected a Fellow of the Royal Geographical Society in 1865. On his return from India in 1880 he was made a member of the Council, an office which he held until 1883. There were few parts of our Indian Empire with which he had not a personal acquaintance, and he took the greatest interest in the geography, not only of India, but of Central Asia generally, though his interest was chiefly centred in the important bearing which geographical conditions have upon political questions. To quote Sir Richard Temple's own words, what was to him important, was "that geography has its noblest function in describing the theatres of human action, and that he who would understand history aright must have a sound basis of geographical knowledge." In the years which immediately followed his return to this country, Sir Richard took a very active interest in the work of the Society. Not only did he frequently take part in the discussions which followed the reading of papers, but in 1880, 1881, and 1882 he himself delivered valuable addresses to the Fellows on "The Highway from the Indus to Candahar," "The Lake Region of Sikkim, on the Frontier of Tibet," and "The Geography of the Birthplace and Cradle of the Mahratta Empire." Sir Richard was a skilful artist, and his sketches added materially to the interest of his description of any country with which he happened to be dealing. In 1882 he was president of the geographical section of the British Association, and at the Southampton meeting in that year read an instructive paper on "The Central Plateau of Asia." As the claims made upon his time by his public engagements increased, Sir Richard was naturally unable to busy himself so actively in the work of the Society, but he travelled in Russia, Egypt, Turkey, Greece, Palestine, Spain, Norway, and America, and that he retained his interest in the Society to the end is evidenced by the fact that so late as May of last year he engaged in the discussion which followed Sir Thomas Holdich's paper on the "Geography of the North-West Frontier of India."

Sir Richard's eldest son, Lieut.-Colonel R. C. Temple, Chief Commissioner and Superintendent of the Andaman and Nicobar islands, who succeeds to the title, is a member of the Society of old standing, and a well-known writer on the Andaman and Nicobar islands.

Prof. Meiklejohn.

Prof. John M. D. Meiklejohn, whose death at the age of seventy-one occurred on April 5, was perhaps most widely known as the author of numerous text-books of history, geography, and literature, greatly in vogue among pupil teachers and other students. His geographical text-books were a great improvement on those

which they superseded, and, in some measure at least, helped to impart interest to and systematize on scientific lines, a subject of which the educational importance had too long been neglected. Prof. Meiklejohn was born at Edinburgh, and graduated at Edinburgh University. One of his first works was a translation of Kant's 'Critique of Pure Reason,' which met with a very favourable reception. After filling various posts in the educational world, he went through the Danish-German war in 1864, as a war-correspondent, and subsequently travelled in various countries on the Continent, including Russia. In 1874, having returned to Scotland and taken up educational work once more, he was appointed assistant-commissioner to the Endowed Schools Commission for Scotland. In 1876 a chair of education was established at St. Andrew's, and Mr. Meiklejohn was chosen to fill it. This professorship he held until his death. Prof. Meiklejohn was elected a Fellow of the Royal Geographical Society in 1886.

Dr. Ballay.

On January 25 the death took place, at St. Louis, Senegal, of M. Ballay, Governor-General of French West Africa. M. Ballay's career affords a striking illustration of the chances of distinction enjoyed by the African traveller, as distinct from all others, during the last quarter of the nineteenth century. He was, indeed, one of the most brilliant members of that not inconsiderable band of Europeans who, having made their first acquaintance with the Dark Continent in the character of pioneer explorers, became, as a result of the scramble for Africa, administrators of the vast areas which they had been instrumental in opening up to European influence. As a traveller, M. Ballay will always be associated with one better known in the geographical world, if less distinguished as an administrator—M. de Brazza. Born in 1846, M. Ballay was educated for the medical profession, and, indeed, qualified to practice as a doctor; but, becoming fired with the ambition to travel, he succeeded in getting appointed second in command of the expedition organized by M. de Brazza in 1875, and accompanied that explorer to the Ogowe river. He remained with de Brazza until the latter, after ascending the Ogowe nearly to its source and discovering the Alima river, returned to France early in 1879. In 1880 he again set out for the Ogowe, where M. de Brazza had preceded him, and after many delays succeeded in tracing the Alima to its junction with the Congo. In 1884 he was summoned to Europe to take part in the Berlin Conference, but the following year again saw him in the Congo basin, this time as one of the commissioners appointed to delimit the frontier between the French Congo and the Congo Free State. Subsequently he filled the posts of Lieut.-Governor of France's Gabun colony, and Governor of French Guinea (1890). This latter country especially he did a very great deal to open up to European influence. In 1900 he accepted the post of Governor-General of French West Africa, and proved unwearying in his efforts to stem the epidemic of yellow fever which has been raging in Senegal. His death, indeed, in his fifty-sixth year, must be attributed to his heroic efforts to prevent the spread of the disease.

Major Casati.

The death was reported from Como, early in March, of Major Gaetano Casati, who will be remembered as one of Emin Pasha's companions during the eventful years that the latter was shut up by the Mahdi in the Anglo-Egyptian Sudan. Casati was born at Lesmo in 1838. In 1859 he entered the corps of Bersaglieri

and took part in both the third and fourth wars of Italian independence against Austria. Subsequently he was appointed to the Topographical Department of the Leghorn Institute, and engaged in the work of constructing the Ordnance Survey maps of Italy. In 1879, when forty-one years of age, Casati resigned his commission in the army in order to be able to devote himself entirely to geographical work. An opportunity of acquiring practical experience as a pioneer explorer speedily presented itself to him. Gessi Pasha, who was then engaged in subduing Suleiman Pasha, wrote home to Italy from the Bahr-el-Ghazal asking that a young officer with some knowledge of cartography might be sent out to him to undertake the exploration of the Wella basin. Casati was selected for the post, and before the end of 1879 was on his way to the Equatorial Province. Shortly after, Gessi Pasha was summoned to Khartum, and Casati found himself left alone in the Bahr-el-Ghazal, practically thrown upon his own resources. The country was in a very unsettled condition, but in spite of the difficulties of the situation Casati continued the operations against the slave-traders as long as he could, and managed to make his way south to the Welle basin. Here he travelled widely, meeting, it may be mentioned, in the course of his wanderings, the famous German traveller Dr. Junker. In 1883, after many exciting experiences, Casati made his way to Lado, where Emin Pasha had taken up his position. Two years later, when Emin found it no longer possible to maintain himself at Lado in face of the Mahdi's troops, Casati accompanied his leader south to Wadelai, and opened up communications with Kabarega, King of Unyoro. At first Kabarega was friendly enough, but on the defeat of some of that monarch's warriors by the expedition sent out from this country under Mr. H. M. Stanley, Casati was made a prisoner, and barely escaped to Emin Pasha with his life. How he and his chief were finally found by Stanley and brought to Bagamoyo is a well-known story. If he made no very striking discoveries during his ten years' residence amongst the headwaters of the Nile, Casati at least collected a good deal of scientific information about the region, and supplemented usefully the work of Junker and Schweinfurth. On his return to Italy he published a somewhat disconnected account of his wanderings, an English translation of which has appeared under the title 'Ten Years in Equatoria.'

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1901–1902.

Ninth Ordinary Meeting, April 14, 1902.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Captain William Henry Beverley, West African Frontier Force; John Robert Brown, B.A.; Edward Alfred Collier, B.A.; Henry Herd Dennis; Henry Cubitt Gooch, B.A., LL.B.; J. P. Hornung; William Milroy; Lieut. G. C. Rodney Mundy, Resident of Ankole Province, Uganda; Almada Negreiros; Charles Parkinson Oates; Arthur Edmund Stearns; Algernon Turnor, C.B.; William Vincent; Charles J. Wallace, M.A., J.P.*

The Paper read was:—

"A Journey from Omdurman to Mombasa *viâ* Lake Rudolf." By Major H. H. Austin, C.M.G., D.S.O., R.E.

THE SOCIETY'S AWARDS.

The PRESIDENT said: I have to announce to the meeting that the Council has assigned the Royal Medal to Major Sykes for his work in Persia, and to General

Sir Frederick Lugard, whose great work in tropical Africa we are all well acquainted with. I may mention that the King now requires the names to be submitted to him for his approval before he orders the money to be given for the medals. The Council, with the approval of the Fellows of the Society, has resolved that there shall be a third Gold Medal in future, to be called the Victoria Medal, for geographical research, not necessarily to be given every year, but this year it has been assigned to Mr. E. G. Ravenstein. The Murchison Grant has been given to Mr. Stanley Gardiner, for his researches in Funafuti island, in the Pacific, and the Maldive islands, in the Indian ocean; the Gill Memorial to Mr. Chisholm, for his great services during many years' connection with geographical education; the Back Grant to Lieut. Amdrup, of the Danish navy, for his services along the coast of Eastern Greenland; and the Peek Award to Mr. Thomson, the founder of the Queensland branch of the Australian Geographical Society, who has done a great deal for geography in Australia.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.	**Mag.** = Magazine.
Abh. = Abhandlungen.	**Mem.** = Memoirs, Mémoires.
Ann. = Annals, Annales, Annalen.	**Met.** = Meteorological.
B. = Bulletin, Bollettino, Boletim.	**P.** = Proceedings.
Com. = Commerce.	**R.** = Royal.
C. Rd. = Comptes Rendus.	**Rev.** = Review, Revue.
Erdk. = Erdkunde.	**S.** = Society, Société, Selskab.
G. = Geography, Geographie, Geografia.	**Sitzb.** = Sitzungsbericht.
Ges. = Gesellschaft.	**T.** = Transactions.
I. = Institute, Institution.	**V.** = Verein.
Iz. = Izvestiya.	**Verh.** = Verhandlungen.
J. = Journal.	**W.** = Wissenschaft, and compounds.
k. u. k. = kaiserlich und königlich.	**Z.** = Zeitschrift.
M. = Mitteilungen.	**Zap.** = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. *Ann. G.* 10 (1901): 295-317, 401-428. **Lugeon.**
Recherches sur l'origine des vallées des Alpes occidentales. Par Maurice Lugeon. *With Illustrations.*

This has been noticed in the Monthly Record (*ante*, p. 210).

Alps—Glacial Epoch. **Penck.**
Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 205-212.
Einige neuere Ergebnisse der Eiszeitforschung in den Alpen. Von Prof. Dr. Albrecht Penck.

Austria—Wienerwald. *G. Abh.* 8 (Heft I.) 1901): pp. 240. **Grund**
Die Veränderungen der Topographie im Wiener Walde und Wiener Becken. Von Dr. Alfred Grund.

This will be specially noticed.

Denmark. ——

Den Danske Turistforenings Aarsskrift, 1902. København: G. E. C. Gad, 1902. Size 9½ × 6, pp. 124 and xlviii. *Illustrations.*

Denmark—Oceanography. *La G., B.S.G. Paris* **5** (1902): 21-40. **Knudsen.**

L'Océanographie des détroits danois. Par Martin Knudsen. *With Map and Diagrams.*

France. *C. Rd.* **134** (1902): 491-493. **Bertrand.**

Sur la tectonique des environs de Biarritz, Bidart et Villefranque (Basses-Pyrénées). Note de M. Léon Bertrand.

France. **Friederichsen.**

Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 232-247.

Die Vulkanlandschaften Central-Frankreichs und die Spuren ihrer ehemaligen Vergletscherung. Von Dr. Max Friederichsen.

France. *C. Rd.* **133** (1901): 897-900. **Termier.**

Nouvelles observations géologiques sur la chaîne de Belledonne. Note de M. Pierre Fermier.

France—Beaujolais. *Ann. G.* **10** (1901): 318-329, 429-437. **Privat-Deschanel.**

Le relief du Beaujolais. Par Paul Privat-Deschanel.

France—Canal. *Rev. G.* **50** (1902): 55-66. **Charpentier.**

Ce que doit être le canal des Deux-Mers. Par M. Charpentier.

While regarding the idea of a canal for large shipping as chimerical, the author thinks that one with a depth of about 13 feet, allowing a passage to vessels used in the coasting trade, would prove the great highway between north-west Europe and the Mediterranean.

France—Census. *Rev. Française* **27** (1902): 88-95. **Cilvanet.**

Le Recensement de 1901 en France. Par C. Cilvanet.

France—Geodesy. *C. Rd.* **133** (1901): 1179-1180. **Bigourdan.**

Sur la mesure de la méridienne de France, par Méchain, à la fin du xviii^{e} siècle. Note de M. G. Bigourdan.

Points out that corrections derived from unpublished observations of Méchain bring his results in many cases nearer those obtained with modern instruments by the Depôt de la Guerre than appears from the values given in the *Base du Système Métrique.*

France—Population. *La G., B.S.G. Paris* **5** (1902): 41-48. **Turquan.**

La population de la France d'après les résultats du recensement de 1901. Par V. Turquan. *With Maps.*

France—Somme. *A travers le Monde, Tour du Monde* **7** (1901): 409-412. ——

Falaises vives et Falaises mortes de la Somme. *With Map and Illustrations.*

France—Springs. *C. Rd.* **133** (1901): 1262-1264. **Martel.**

Sur de nouvelles constatations relatives à la contamination des résurgences (sources vauclusiennes) des terrains calcaires en France. Note de M. Martel.

Germany. **Baedeker.**

Southern Germany. Handbook for Travellers. By Karl Baedeker. Ninth Revised Edition. Leipsic: K. Baedeker; London: Dulau & Co. 1902. Size 6½ × 4½, pp. xxviii. and 296. *Maps and Plans. Presented by Messrs. Dulau & Co.*

This edition, which corresponds with the 27th German edition, has been enlarged by the addition of thirty pages of text and seven more maps and plans than were given seven years ago in the 8th edition.

Germany. *Z. Ges. Erdk. Berlin* **36** (1901): 219-229. **Frech.**

Ueber glaciale Druck- und Faltungserscheinungen im Oder-Gebiet. Von Prof. Dr. F. Frech. *With Plates.*

Germany—Erzgebirge. *C. Rd.* **134** (1902): 96-98. **Ballore.**

Les tremblements de terre de plissement dans l'Erzgebirge. Note de M. F. de Montessus de Ballore.

The author regards the slight seismic phenomena still observable in the region of the Erzgebirge as the last manifestations of the tectonic forces to which the range owed its origin.

Germany—Folk-lore. *Globus* **81** (1902): 63. **Krebs.**

Geologische und meteorologische Motive einiger an Thüringer Seen geknüpften Sagen. Von Wilhelm Krebs.

Germany—Glacial Epoch. **Götz.**
Verh. Dreizehnten Deutsch. Geographentages, Breslau (1901): 213–217.
Der Verlauf der diluvialen Eiszeit in Schwaben. Von Prof. Dr. Wilhelm Götz.

Germany—Lakes. *Globus* 81 (1902): 7–12. **Halbfass.**
Ueber einige Einsturzbecken im nord-westlichen Thüringen und in der Vorderrhön. Von Dr. W. Halbfass. *With Maps and Profiles.*

These small but remarkable lakes were examined by Dr. Halbfass last year, and soundings made.

Germany—Nomenclature. **Vigener.**
Bezeichnungun für Volk und Land der Deutschen vom 10. bis zum 13. Jahrhundert. Von Fritz Vigener. Heidelberg: Carl Winter, 1901. Size 9 × 6, pp. viii. and 272.

An extension of a prize essay written in 1899 for the Philosophical Faculty at Heidelberg. The author treats exhaustively of the various designations bestowed on Germany and the Germans in the European literature of the period mentioned.

Germany—Ports. **Reinhard.**
Die wichtigsten Deutschen Seehandelsstädte. Ein Beitrag zur Geographie deutscher Städte. Von Dr. Rudolf Reinhard. (Forschungen zur deutschen Landes- und Volkskunde herausgegeben von Dr. A. Kirchhoff. XIII. Bd. Heft 6.) Stuttgart: J. Engelhorn, 1901. Size 9½ × 6½. *Plans and Illustrations.*

Greece—Kimolos. *B.S.R. Belge G.* 25 (1901): 350–366. **Hauttecœur.**
L'Ile de Kimolos. Par Henry Hauttecœur. *With Map.*

Greece—Railways. *Deutsche Rundschau G.* 24 (1902): 193-204. **Struck.**
Zur Geschichte der Eisenbahnen Griechenlands. Eine statistische Uebersicht von Ad. Struck. *With Map.*

Holland. *La G., B.S.G. Paris* 5 (1902): 49–53. **Van Baren.**
Description géographique de la Hollande au sud du Lek et de la nouvelle Meuse, au moyen âge. Par J. Van Baren. *With Maps.*

Holland—Terminology. **Beekman.**
Tijds. K. Ned. Aard. Genoots, Amsterdam 19 (1902): 1–58.
Nomina Geographica Neerlandica uit een geographisch oogpunt beschouwd. Door A. A. Beekman. *With Maps.*

An exhaustive disquisition on the meaning and usage of the terms Koog and Kogge as applied to geographical features in Holland.

Italy—Earthquakes. *Petermanns M.* 47 (1901): 265–271 **Gerland.**
Die italienischen Erdbeben und die Erdbebenkarte Italiens. Von Prof. Dr. G. Gerland. *With Map.*

Italy—Seismology. *B.S.G. Italiana* 2 (1901): 882–893. **Baratta.**
A proposito dei "Mistpoeffers" italiani. Nota del socio Mario Baratta. *With Map.*

On detonation-phenomena, locally known as "Balza" or "Trabuzzo," observed in north-east Tuscany.

Italy—Sicily—Messina. *B.S.G. Italiana* 3 (1902): 8-39. **Ricchieri.**
Tre escursioni in provincia di Messina. Note staccate del socio Prof. G. Ricchieri.

Italy—Vesuvius. **Melander.**
Öfversigt Finska Vet.-S. Förhandlingar 43 (1900–1901): 148–160.
L'influence du Vésuve sur l'air des environs. Par G. Melander.

Mediterranean. *Petermanns M.* 47 (1901): 284–285. **Henkel.**
Die Grenze der Sichtbarkeit des Landes auf dem Meere. Von Dr. L. Henkel. *With Map.*

This is referred to in a note (*ante*, p. 502).

Montenegro—Glaciation. **Hassert.**
Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 218–231.
Gletscherspuren in Montenegro. Von Prof. Dr. Kurt Hassert. *With Map.*

Northern Europe—Coasts. *Fennia* 18 (1900–1901), No. 7: 1–13. **Bonsdorff.**
Om landhöjningen vid Rusterna af Östersjön och Kattegat. Af A. Bonsdorff.

On the evidences of elevation on the coasts of Sweden, Finland, etc.

Russia. *G.Z.* 8 (1902): 23–43. **Tschulok.**
Das Moskaner Industriegebiet und der Oberlauf der Wolga. Von S. Tschulok.

Russia—Black Sea coast. *Ciel et Terre* **22** (1902): 505–510. **Tronquoy.**
De la formation des lagunes dites "Limans" des environs d'Odessa. Par G. du Tronquoy. *With Map.*

Russia—Finland. *Fennia* **18** (1900–1901), No. 9: 1–22. **Frosterus.**
Hufvudtyper inom de sydfinska landskapsformerna och berggrundens betydelse för uppkomsten af dem. Af Benj. Frosterus.

On the types of surface in Southern Finland.

Russia—Finland. *Fennia* **18** (1900–1901), No. 5: 1–26. **Hammarström.**
Om strandbildningar och marina gränsen i södra österbotten och angränsande trakter. Af R. Hammarström.

On recent investigations of raised beaches and allied phenomena.

Russia—Finland. **Homén.**
Öfversigt Finska Vet.-S. Förhandlingar **43** (1900–1901): 333–350.
Om skogarnas inflytande på Finlands Klimat. Föredrag af Th. Homén.

United Kingdom—New Forest. *Blackwood's Mag.* **170** (1901): 658–667. **Gleig.**
A Village in the New Forest. By Charles Gleig.

United Kingdom—Scotland. *Scottish G. Mag.* **17** (1901): 644–651. **Newbigin.**
Sir John Murray's Scheme for the Investigation of the Natural History of the Forth Valley. By Marion Newbigin, D.SC.

United Kingdom—Somerset. **Buckman.**
Excursion to Dundry Hill, Thursday, May 30. Director S. S. Buckman. Report by the Director. (Reprinted from the *Proceedings of the Geologists' Association*, vol. xvii. part iv., August, 1901, pp. 152–158.) *Diagrams. Presented by the Author.*

United Kingdom—Wales. **Edwards.**
Wales. By Owen M. Edwards. (Story of the Nations Series.) Second Impression. London: T. Fisher Unwin, 1902. Size 8 × 5, pp. xxiv. and 422. *Maps and Illustations. Presented by the Publisher.*

In the opening chapter the author shows clearly the way in which Welsh history has been influenced by the physical geography of the country, the four natural divisions corresponding roughly with the four political centres of the country now represented by the four dioceses.

United Kingdom—Wales. **Hudson.**
A Geography of Wales intended chiefly for use in Welsh Schools. By A. E. L. Hudson. London: Macmillan & Co., 1901. Size 7 × 5, pp. xii. and 164. *Maps and Illustrations. Price* 1*s.* 6*d. Presented by the Publishers.*

A distinct advance on the ordinary school text-books, the author having endeavoured throughout to keep in view the modern conception of geography as the study of the Earth considered as the abode of man.

ASIA.

Arabia. *J. of T. Victoria I.* **33** (1901): 311–333. **Zwemer.**
The Wahābīs: their Origin, History, Tenets, and Influence. By Rev. S. M. Zwemer.

Asia. **Monnier.**
Marcel Monnier. Itinéraires a travers l'Asie levés au cours du voyage accompli durant les années 1895, 1896, 1897, 1898 sur l'initiative et pour le compte du journal *Le Temps*, publiés sous le patronage de la Société de Géographie avec le concours du Ministère de l'Instruction Publique et des Beaux-Arts. With Atlas. Paris: Plon-Nourrit et Cie., 1900. Size 8 × 5 (Atlas 15 × 11½), pp. 248. *Plan and Illustrations. Price* 21*s.*

The text reproduces the daily itinerary notes of the traveller, and the atlas gives the results of his compass surveys on the scales of 1 : 150,000 (China-Korea) and 1 : 750,000 (Mongolia, Central Asia, Persia).

Asia. *Monthly Rev.* **6** (1902): 17–33. **Younghusband.**
European Expansion in Asia. By Major F. E. Younghusband, C.I.E.

Asia. **Zichy, Jankó, and Horváth.**

Dritte Asiatische Forschungsreise des Grafen Eugen Zichy. Band i. Herkunft der Magyarischen Fischerei, von Dr. Johann Jankó. Mit einem Vorläufigen Berichte des Grafen Eugen Zichy. Budapest: Victor Hornyánszky; Leipzig: Karl W. Hiersemann. 1900. Size $12\frac{1}{2} \times 9\frac{1}{2}$, pp. 634. *Illustrations. Price* 25*s*. Ditto. Band ii. Zoologische Ergebnisse. Redigirt von Dr. G. Horváth. 1901. Pp. xlii. and 472. *Illustrations. Price* 25*s*.

The first two volumes of a monumental work on the scientific results of Count Zichy's last journey across Northern Asia, undertaken mainly for ethnological research.

Caspian Sea. *Mem. Hydrography* **23** (1901): 256–307. **Lebedintseff.**

Chemistry of the Caspian Sea. By A. Lebedintseff. [In Russian.] *With Chart and Diagrams.*

Central Asia. *Fennia* **18** (1900–1901), No. 4: 1–53. **Donner.**

Voyage en Turkestan et en Dzoungarie en 1898. Par Otto Donner. *With Map.*

China. **Cordier.**

Histoire des Relations de la Chine avec les puissances occidentales 1860–1900. II. L'Empereur Kouang-Siu. Première partie, 1875–1887. Par Henri Cordier. Paris: F. Alcan, 1902. Size $9 \times 5\frac{1}{2}$, pp. 650. *Price* 7*s*. 6*d*.

The first volume of this important work appeared last year.

China. **Madrolle.**

Cl. Madrolle. Les premiers voyages français à la Chine: la Compagnie de la Chine, 1698–1719. Paris: A. Challamel, 1901. Size $11 \times 7\frac{1}{2}$, pp. viii., lxxxii., and 288. *Maps. Price* 25 *fr. Presented by the Author.*

The circumstances attending the first commercial ventures of the French to the coasts of China are less generally known than those of other nations, and M. Madrolle has done good service in bringing them clearly together in this volume. The introduction sketches the events which led to the formation of the successive "China companies" from 1698 onwards, and the bulk of the volume reproduces accounts of the voyages of the *Amphitrite* and other ships, mostly from unpublished documents. While showing that the voyage of the *Amphitrite* (1698–1700) is the first French voyage of which definite information exists, the author allows it to be possible that this vessel had been preceded by others.

China. *Ann. Hydrographiques* **2** S. (1901): 36–39. **Pirot.**

Note sur la détermination, par transport du temps, de la longitude de Chin-Wan-Tao (golfe du Petchili). Remarque sur la longitude de Tchefou. Par M. le lieutenant Pirot.

China. *Rev. Française* **27** (1902): 83–88. **Servigny.**

La Navigation du Yang-Tsé. Par J. Servigny.

China. **Smith.**

China in Convulsion. By Arthur H. Smith. 2 vols. Edinburgh and London: Oliphant and Co., 1901. Size 9×6, pp. (vol. i.) xvi. and 364; (vol. ii.) 365–770. *Price* 21*s*. *Maps and Illustrations.*

The author of this work is well known for his former instructive studies of Chinese life and character. He now supplies a full and impartial narrative, from observation at first hand, of the troublous events of the past two years, together with a study of the forces which have operated to bring about the present condition of things, and a forecast of the future.

China—Hong Kong. **Lockhart.**

Hong Kong. Report on Operations in the New Territory during 1900. Colonial Reports, Miscellaneous, No. 18, 1901. Size $9\frac{1}{2} \times 6$, pp. 28. *Price* 2*d*.

China—Kiau-chau. *Deutsch. Kolonialzeitung* **18** (1901): 470–472, 485. **Maercker.**

Die Entwicklung des Kiautschou-Gebietes. Von Maercker. 2. Tsingtau als Eingangspforte von Schantung. *With Map.*

China—Pechili. *Deutsche Rundschau G.* **24** (1902): 145–151. **Nishiwada.**

Kurzer Bericht über eine Reise nach Schehol in Nord-China auf dem Lan-hô. Von K. Nishiwada. *With Map.*

The map and accompanying sections show the geological formations along the route.

China—Yang-tse Kiang. *Ann. Hydrographiques* 2 S. (1901): 16–17. **Lefèvre.**
Extrait d'un rapport de M. le capitaine de frégate Lefèvre, commandant le croiseur le *Bugeaud*, relatif à la navigation de ce bâtiment sur le Yang-tse Kiang, pendant la crue du mois de juillet 1901.

China—Yang-tse Kiang. *Rev. Maritime* 152 (1902): 115-140. **Sauerwein.**
La vallée du Yang-tse-Kiang. Par Charles Sauerwein.

Dutch East Indies. **Van der Chijs.**
Dagh-Register gehouden int Casteel Batavia vant passerende daer ter plaetse als over geheel Nederlandts-India Anno 1673. Uitgegeven door het Bataviaasch Genootschap van Kunsten en Wetenschappen, met medewerking van de Nederlandsch-Indische Regeering en onder toezicht van J. A. Van der Chijs. Batavia; 'sHage: M. Nijhoff. 1901. Size 11 × 7½, pp. 378.

Eastern Asia. *Ann. Hydrographiques* 2 S. (1901): 117–197. **Froc.**
L'atmosphère en Extrême-Orient pendant les six mois froids; son état normal; ses perturbations. Avis aux navigateurs par le Père Aloys Froc, S.J. *With Diagrams.*

India—Dutch Factories. **Van der Kemp.**
Bijd. Taal-, Land- en Volkenk. Ned.-Indië 9 (1901): 285–511.
De Nederlandsche Factorijen in vóór-Indië in den aanvang der 19e eeuw. Door P. H. van der Kemp. *With Map.*

India—Early Map. *Scottish G. Mag.* 18 (1902): 84–87. **Cash.**
The First English Map of India. By C. G. Cash. *With Maps. Also separate copy, presented by the Author.*

On a copy of a hitherto unrecorded second edition of Baffin's Map of India.

India—Himalayas. *Alpine J.* 21 (1902): 33–35. **Freshfield.**
Mount Everest, or Jomokangkar. By D. W. Freshfield.

Mr. Freshfield's reply to Dr. Ruge's note in *Petermanns Mitteilungen* on the name of Mount Everest.

India—Historical. *B.S.G. Italiana* 3 (1902): 92–129. **Peragallo.**
Viaggio di Matteo da Bergamo in India sulla flotta di Vasco da Gama (1502–1503), due documenti inediti pubblicati per cura e studio del Prospero Peragallo.

India—Kashmir. *Alpine J.* 21 (1902): 31–33. **Neve.**
The Pir Punjal Range and Tatticooti, Kashmir. By Dr. Ernest F. Neve. *With Illustration.*

India—Mishmi Country. **Ward.**
Military Report on the Mishmi Country published by the Intelligence Branch, Quartermaster-General's Department. By Lieut. G. L. S. Ward. Simla, 1901. Size 10 × 6, pp. 26. *Map and Illustrations. Presented by the Assistant Quartermaster-General, Intelligence Branch, Simla.*

India—Rampur. *Mem. Geolog. Surv. India* 32 (1901): 89 124. **Reader.**
Report on the Rampur Coal-field. By G. F. Reader. *With Map and Sections.*

India—Wainád. **Hayden and Hatch.**
Mem. Geolog. Surv. India 33 (Pt. 2) (1901): 1–48.
The Gold-fields of Wainád. By H. H. Hayden and F. H. Hatch, PH.D. *With Maps and Plates.*

Indian Ocean—Maldive Islands. **Willis and Gardiner.**
The Botany of the Maldive Islands. By J. C. Willis and J. Stanley Gardiner. (Extracted from Part 2 of vol. i. of the Annals of the Royal Botanic Gardens, Peradeniya.) [1901.] Size 9½ × 6, pp. 120. *Map. Presented by J. Stanley Gardiner, Esq.*

Indian Ocean—Minikoi. **Willis.**
Note on the Flora of Minikoi. By J. C. Willis. (Extracted from Part 2 of vol. i. of the Annals of the Royal Botanic Gardens, Peradeniya.) [1901.] Size 9½ × 6, pp. 6. *Presented by J. Stanley Gardiner, Esq.*

Japan—Ainu. **Batchelor.**
The Ainu and their Folk-Lore By the Rev. John Batchelor. London: The Religious Tract Society, 1901. Size 9 × 5½, pp. xxvi. and 604. *Illustrations. Presented by the Publishers.*

The present work is intended to supersede the well-known work of the same author

published in 1892, but is far from being merely a revised edition, as it includes a large amount of new material, while embodying in a corrected form much that appeared in the former work. It is a valuable storehouse of facts for the ethnological student.

Japan—Trade. **Longford.**

Foreign Trade and Shipping of Japan, 1872–1900. Foreign Office, Miscellaneous, No. 564, 1901. Size 9½ × 6, pp. 10. *Price* 1*d*.

Korea. *T. Korea Br. R. Asiatic S.* **2** (1901): 1–36. **Trollope.**

Kang-wha. By Rev. M. N. Trollope.

A full account of the island of Kang-wha, lying off the west coast of Korea.

Malay Archipelago. **Haeckel.**

Aus Insulinde. Malayische Reisebriefe. Von Ernst Haeckel. Bonn: Emil Strauss, 1901. Size 10 × 6½, pp. xii. and 260. *Map and Illustrations. Price* 9*s*.

This will be specially noticed.

Malay Archipelago—Borneo. **Haddon.**

Head-Hunters, Black, White, and Brown. By Alfred C. Haddon. London: Methuen & Co., 1901. Size 9 × 6, pp. xxiv. and 426. *Maps and Illustrations. Price* 15*s*. *Presented by the Publishers.*

This will be specially reviewed.

Malay Archipelago—Java. *J. United Service I. India* **31** (1902): 1–17. **Burton.**

The Conquest of Java. By Captain R. G. Burton. *With Map and Plan.*

Malay Archipelago—Java. **Niermeyer.**

Tijds. K. Ned. Aard. Genoots. Amsterdam **19** (1902): 171–174.

De uitbarsting van 1593: Raun of Ringgit? Door J. F. Niermeyer.

Russia—Siberia. *Questions Dipl. et Colon.* **12** (1901): 656–671. **Labbé.**

La Colonisation en Sibérie; la Steppe Kirghize. Par Paul Labbé. *With Map.*

Russian Central Asia. *Rev. Française* **26** (1901): 710-716. ———

Raccordement du Transcaspien. Par G.V. *With Map.*

On the projects set on foot for the purpose of connecting the Trans-Caspian railway with the Siberian lines.

Russian Turkestan. **Krafft.**

Hugues Krafft. À travers le Turkestan Russe. Paris: Hachette et Cie., 1902. Size 14 × 10, pp. viii. and 230. *Illustrations. Price* £3.

This magnificently illustrated work will be reviewed elsewhere in the *Journal*.

Turkey—Asia Minor. *Sitzb. A.W. Wien* **109** (Ab. 1) (1900): 498–525. **Schaffer.**

Geologische Studien im südöstlichen Kleinasien. Von Dr. Franz Schaffer.

Turkey—Palestine. **Conder.**

Quarterly Statement, Palestine Exploration Fund (1902): 97–105.

Zuallardo's Travels. By Colonel C. R. Conder.

Turkey—Palestine—Dead Sea. *Ciel et Terre* **22** (1901): 55–64. **Gautier.**

La mer Morte. Par L. Gautier.

AFRICA.

Abyssinia. **Le Roux.**

Hugues Le Roux. Ménélik et Nous. Le Carrefour d'Aden. La Route d'Addis-Ababâ. Je suis l'hôte du Négus. Vers le Nil Bleu. France et Abyssinie. Paris: Nilsson. [1901.] Size 9½ × 6½, pp. 446. *Maps and Illustrations. Price* 10 *fr*. *Presented by the Author.*

A brightly written popular account of M. de Roux's journey in Abyssinia, which has been more than once referred to in the *Journal*. In the first chapter the author expresses his opinions as to the political relations of Abyssinia, especially with France. He has a great admiration for the statesmanship of Menelik (whom he likens to Louis XIV.), and believes in the high commercial importance of the Jibuti-Harrar railway. There are two good maps, one showing the region from the coast to Addis Abbaba, the other, reproduced from *La Géographie* (cf. *ante*, p. 87), that of the Blue Nile.

Africa—Zoogeography. *Naturw. Wochenschrift* **1** (1901): 145–150. **Kolbe.**

Ueber die Entstehung der zoo-geographischen Regionen auf dem Kontinent Afrika. Von Prof. H. J. Kolbe.

Azores. **Mees.**

Histoire de la découverte des iles Açores et de l'origine de leur dénomination d'iles Flamandes. Par Jules Mees. (Université de Gand. Receuil de travaux publiés par la Faculté de Philosophie et Lettres. 27me fascicule.) Gand: Librairie, Vuylsteke, 1901. Size 10 × 6½, pp. 144. *Maps. Presented by the Author.*

British East Africa. **Watt.**

Vocabulary of the Kikamba Language. By Stuart Watt. Harrisburg, Pa.: Fred. Kelker, 1900. Size 5¼ × 3, pp. 154. *Presented by the Author.*

The R.G.S. system of orthography is in the main followed, but a sensible innovation is the use of the sign ' to separate the *g* sound from that of the preceding *n* in such words as *kilin'gi*, and to combine the two into the nasal sound in others, like *king'ang'i*.

British Possessions. *Scottish G. Mag.* 18 (1902): 57–76. **Johnston.**

The Protectorates of Great Britain in Tropical Africa. By Sir Harry H. Johnston, G.C.M.G., K.C.B.

Cape Colony. **Black.**

The Fish River Bush, South Africa, and its Wild Animals. By W. T. Black. Edinburgh and London: Young J. Pentland, 1901. Size 9 × 6, pp. 56. *Illustrations. Presented by the Author.*

Reprinted from the *Edinburgh New Philosophical Journal* of July and October, 1853. The author was stationed in the Fish river district during the Caffre wars.

Cape Colony—Geology. ———

Cape of Good Hope. Department of Agriculture. Annual Report of the Geological Commission, 1898. (Pp. 98.) Ditto, 1899. Cape Town, 1900. Size 10 × 8, pp. 110.

Central Africa. *Church Miss. Intelligencer* 53 (1902): 181–192. **Crabtree and Buckley.**

On the Slopes of Mount Elgon. Letters from the Rev. and Mrs. W. A. Crabtree and the Rev. T. R. Buckley.

Central Africa. *La G., B.S.G. Paris* 4 (1901): 297–320; 419–448. **Dyé.**

Positions géographiques déterminées astronomiquement en Afrique Centrale au cours de la Mission Marchand. Par A. H. Dyé. *With Map.*

See note in the April number (p. 505).

Congo State—Katanga. *La G., B.S.G. Paris* 4 (1901): 321–338; 403–418. **Lemaire.**

Grottes et Troglodytes du Ka-Tanga. Par Capitaine Ch. Lemaire. *With Map and Illustrations.*

East Africa—Nyanja Language. **Hetherwick.**

A Practical Manual of the Nyanja Language. By the Rev. Alexander Hetherwick. London: Society for Promoting Christian Knowledge, 1901. Size 6½ × 4, pp. xviii. and 256. *Presented by the Author.*

A companion volume to the same author's 'Handbook of the Yao Language' (see below), on a similar plan, though less space is given to the vocabularies. It should be of much use as providing a simple guide to the principal language of the British Central Africa Protectorate.

East Africa—Yao Language. **Hetherwick.**

A Handbook of the Yao Language. By the Rev. Alexander Hetherwick. Second Edition. Revised and Enlarged. London: Society for Promoting Christian Knowledge, 1902. Size 6½ × 4, pp. xxii. and 420. *Presented by the Author.*

The additions to the work as it first appeared in 1889, consist chiefly in the enlargement of the Yao-English vocabulary, and the inclusion for the first time of an English-Yao vocabulary, based on one compiled by the Domasi mission press. Some extra illustrations of points in grammatical structure have also been added to Part i.

Egypt. **Beadnell.**

Découvertes géologiques récentes dans la vallée du Nil et le désert Libyen. Par M. Hugh J. L. Beadnell. (Extrait du Compte rendu du VIIIᵉ. Congrès géologique international, 1900.) Paris, 1901. Size 10 × 6½, pp. 28. *Map and Illustrations. Presented by the Author.*

This contains illustrations not given with the English translation already noticed in the *Journal.*

Egypt. **Willcocks.**

The Nile Reservoir Dam at Assuân and After. By W. Willcocks, C.M.G. London:

E. & F. N. Spon, 1901. Size 10½ × 7, pp. 30. *Plans and Illustration.* *Price* 6s. *net.* *Presented by the Publishers.*

A useful sketch of the history of the Nile reservoir scheme, the designs for which were drawn up by the author in 1895 when Director-General of Reservoirs in Egypt, with a forecast of the possibilities of future development of irrigation works throughout the Nile basin. The author considers that works undertaken in various parts of the Sudan would both bring prosperity to that region and at the same time save Egypt from the risks attending an unusually high flood, while ushering in an era of prosperity in that country surpassing the wildest estimates yet made.

Egyptian Sudan. **Gwynn.**

Surveys on the Proposed Sudan-Abyssinian Frontier. By Major C. W. Gwynn. (From the *Geographical Journal* for December, 1901.) Size 10 × 6½, pp. 12. *Map and Illustrations.*

Egyptian Sudan. **Witherby.**

Bird Hunting on the White Nile: A Naturalist's Experiences in the Sudan. By Harry F. Witherby. London: Office of *Knowledge*, 1902. Size 8 × 5½, pp. 118. *Illustrations.* *Presented by the Author.*

The author is evidently a careful observer, and gives interesting details respecting the bird-life on the White Nile above Omdurman, where he collected in 1900: such points as the migrations of certain species, and the protective colouring or attitudes of others, being frequently touched upon. The several chapters are reprints, with slight alterations, of a series of articles in *Knowledge*. An interesting fact noted is that objects of barter were useless throughout, money being always demanded as payment for goods.

Eritrea. *Riv. G. Italiana* 9 (1902): 52–64. **Rossini.**

Il censimento delle popolazioni indigene della Colonia Eritrea. Relazione di Carlo Conti Rossini.

French Somaliland. *Mouvement G.* 19 (1902): 79–83. ———

Le chemin de fer de Djibuti à Harar.

German East Africa. *Globus* 81 (1902): 53–57. **Kannengiesser.**

Verkehrsverhältnisse in Deutsch-Ostafrika. Von G. A. Kannengiesser.

German East Africa. **Kohlschütter.**

Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 133–153.

Die kartographischen und geophysischen Arbeiten der Pendel-Expedition der Königlichen Gesellschaft der Wissenschaften zu Göttingen in Deutsch-Ost-Afrika. Von Dr. E. Kohlschütter. *Maps.* *Also separate copy presented by the Author.*

This is noticed in the Monthly Record (*ante*, p. 639).

German Protectorates. *J. African S.* 1 (1902): 184–191. **Zimmerman.**

Trade of the German Protectorates. By Dr. Alfred Zimmerman.

German South-West Africa. **Schenck.**

Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 154–166.

Deutsch-Südwest-Afrika im Vergleich zum übrigen Süd-Afrika. Von Prof. Dr. Adolf Schenck.

The writer shows that as regards geology and physical geography, South-West Africa stands apart from the greater part of South Africa, and that great gold discoveries are not to be expected, though the case is different as regards diamonds and copper. The climate is analogous to that of the Karroo, and success may therefore be expected from attempts to develop stock-rearing industries, especially in the case of the merino sheep and Angora goat.

German South-West Africa. **[Volkmann.]**

Deutsch. Kolonialblatt 12 (1901): 866–868, 908–909, 912.

Reise von Grootfontein nach dem Okavango.

Italian Somaliland. **Pestalozza.**

Somalia Italiana. Il Sultanato dei Migiurtini. Rapporto del cav. G. Pestalozza. (B. Ministero Affari Esteri, Ottobre 1901.) Roma, 1901. Size 9 × 6, pp. 44. *Map.*

Kamerun. *M. Deutsch. Schutzgeb.* 14 (1901): 209–213. **Danckelman.**

Die Höhenmessungen von Dr. Esch in Kamerun. Bearbeitet von Dr. v. Danckelman.

Kamerun. *M. Deutsch. Schutzgeb.* 14 (1901): 214–222. **Moisel.**
Begleitworte zu der Karte "Die Flussgebiete des Mungo und Unteren Wuri." Von M. Moisel. *With Map.*

Kamerun. *M. Deutsch. Schutzgeb.* 14 (1901): 223. **Schnauder.**
Astronomische Ortsbestimmungen in Kamerun, angestellt von Dr. Esch. Berechnet von Prof. M. Schnauder.

Kamerun. **Stein.**
Deutsch. Kolonialblatt 12 (1901): 742–746; 13 (1902): 8–10, 42–45, 64–67.
Expedition des Freiherrn v. Stein.

See notes in the February and present numbers (pp. 218, 638).

Kamerun. **Spellenberg.**
Beiträge Kolonialpolitik 3 (1901–1902): 185–192, 211–216, 243–248.
Ein Beitrag zur Land- und Völkerkunde von Kamerun-Hinterland. Von G. Spellenberg.

Madagascar. **Grandidier.**
Histoire physique, naturelle et politique de Madagascar publiée par Alfred Grandidier. L'Origine des Malgaches, par Alfred Grandidier. Paris: Imprimerie Nationale, 1901. Size 13 × 10, pp. 180. *Presented by the Author.*

This is the first part of the ethnographical section of the great work on Madagascar, published under M. Grandidier's direction, which is to form when complete fifty-two volumes. The writer sums up with great clearness the conclusions as to the eastern origin of the Malagasy to which he was first led in 1872, and which have since been accepted by most anthropologists.

Madagascar. *Rev. Française* 27 (1902): 25–31. **Gallieni.**
Le développement de Madagascar. Par G[al] Gallieni.

Madagascar. *Rev. Madagascar* 3 (1901): 930–935. **Hérault.**
Les Ressources minières de Madagascar. Par Philippe Hérault.

Madagascar. *Rev. Madagascar* 3 (1901): 761–767. **Huet.**
Histoire de l'occupation du territoire des Antaimorona par les Hova depuis 1842 jusqu' à l'arrivée des Français. Résumé des guerres entre Antaiony, Ampanabaka et Zanaseranana. Par C. Huet.

Madagascar. *Rev. Madagascar* 3 (1901): 844–855. **Sainjon.**
Le pays Antanosy. Par Lieutenant Sainjon. *With Map.*

Madagascar—Gold. *Rev. Française* 26 (1901): 522–527. **Servigny.**
L'or à Madagascar. Par J. Servigny.

Madeira. *B.S.G. Lisboa* 18 (1900): 5–13. **Martins.**
A Madeira e o seu clima. Pelo Dr. João Augusto Martins.

Morocco. **Doutté.**
Renseignements Colon., B. Comité l'Afrique Française 11 (1901): 161–178.
Une Mission d'études au Maroc. Le Voyage de M. Edmond Doutté. *With Map.*
See note, *ante*, p. 375.

Morocco. *Deutsche Rundschau G.* 24 (1901): 49–55. **Floericke.**
Marokko. Seine wirthschaftliche Bedeutung und seine politische Zukunft. Von Dr. Curt Floericke. *Map.*

Morocco. *Beitrage Kolonialpolitik* 3 (1901–1902): 176–182. **Jaap.**
Marokko. Von W. Jaap.

Morocco. *B.S.G. Com. Paris* 22 (1901): 400–405. **Roquevaire.**
Note sur le voyage au Maroc de Georges Forret. Par René de Flotte Roquevaire. *With Map.*

Nigeria—Hausa Language. **Miller.**
Hausa Notes. By Walter R. Miller. London: Henry Frowde, 1901. Size 7½ × 5, pp. 128. *Presented by the Publisher.*

As stated by General Lugard in the preface, this little work is likely to prove of great assistance to officials and others whose work lies among the Hausa peoples. The work is quite original, and elucidates many points of grammar left unnoticed by previous writers.

North-East Africa. **Keller.**
Die landwirtschaftlichen Zustände im afrikanischen Osthorn. Von Prof. Dr. C. Keller. (Festschrift der Geographisch-Ethnographischen Gesellschaft in Zürich, pp. 127–143.) Zurich: F. Lohbauer, 1901. Size 9 × 6½. *Illustrations.*

Portuguese West Africa. **Negrevios.**
Colonies Portugaises. Ile de San-Thomé. Par Almada Negreiros. Paris: A. Challamel, 1901. Size 10 × 6½, pp. 166. *Maps and Illustrations. Presented by the Author.*

A welcome summary of our knowledge of San Thomé.

Sierra Leone. *B. Comité l'Afrique Française* 11 (1901): 395–401. **Salesses.**
Le chemin de fer de Sierra-Leone. Par le capitaine E. Salesses. *With Map.*

Transvaal. *Ann. G.* 10 (1901): 450–453. **Gallois**
La Géologie du Transvaal d'après M. Molengraaff. *With Sections.*

Based on a memoir in the *Bulletin* of the Geological Society of France.

Uganda—Railway. **Molesworth.**
The Uganda Railway. By Sir Guildford Molesworth. (International Engineering Congress, Glasgow, 1901. Section I. Railways.) Size 10 × 6½, pp. 10. *Maps and Illustrations. Presented by the Author.*

A sketch of the inception and execution of the Uganda Railway project.

Uganda—Railway. ———
Africa. No. 8 (1901). Report by the Mombasa-Victoria (Uganda) Railway Committee on the Progress of the Works, 1900–1901. London: Eyre & Spottiswoode, 1901. Size 13 × 8½, pp. 12. *Map. Price 8d.*

West Africa. *Globus* 80 (1901): 384–386. **Hutter.**
Der westafrikanische Bantuneger, Seine Charakteristik und Behandlung. Von Hauptmann a. D. Hutter.

West Africa—Gold. *J. School G.* 5 (1901): 333-339. **Speak.**
The Gold-producing Region of West Africa. By S. J. Speak.

NORTH AMERICA.

America—Historical. **Fischer.**
Die Entdeckungen der Normannen in Amerika. Unter besonderer Berücksichtigung der kartographischen Darstellungen. Von Jos. Fischer, S.J. Freiburg im Breisgau: Herdersche Verlagshandlung, 1902. Size 9½ × 6, pp. xii. and 126. *Maps. Price* 2 80*m. Presented by the Publisher.*

This will be specially noticed.

Bermuda. **Cole.**
Bermuda and the *Challenger* Expedition. A Bibliography giving a Summary of the Scientific Results obtained by that Expedition at and near Bermuda in 1873. By Geo. Watson Cole. Boston: Printed for Private Distribution, 1901. Size 9½ × 6, pp. 16. *Presented by the Author.*

Canada. *T. and P. New Zealand I.* 33 (1900): 552–554. **Hector.**
Early Explorations and Colonisation of Western Canada. By Sir James Hector. [Abstract.]

Canada—Altitudes. **White.**
Geographical Survey of Canada. Altitudes in the Dominion of Canada, with a Relief Map of North America. By James White. Ottawa, 1901. Size 10 × 7, pp. x. and 266. *Map and Profiles. Presented by the Author.*

This is valuable as the first general compilation of altitudes in Canada, and is based on all available information, including railway and canal profiles, reports and maps of the Geological Survey, reports on irrigation surveys, etc., etc. The map shows contours at five stages from 100 to 10,000 feet.

CENTRAL AND SOUTH AMERICA.

Argentine Republic—La Plata. *An. S. Ci. Argentina* 52 (1901): 209–234. **Foster.**
Régimen del Rio de la Plata y su corrección. Por Alejandro Foster. *With Maps.*

This will be noticed in the Monthly Record.

Bolivia. *B.S.G. La Paz* 3 (1901): 394–432, 481–498. **Wendt.**
El Distrito minero de plata de Potosi, Bolivia. Por Arturo F. Wendt. (Traducción de Manuel V. Ballivián y Edmundo Sologuren.) *With Plate.*

Bolivia—Census. *B. Oficina Nac. Inmigración, etc.* 1 (1901): 667–861. ——

Censo Nacional de la Población de la República [1° de Setiembre de 1900]. Informes de la Comisión Nacional sobre los resultados generales y primeros resúmenes de cada Departmento.

Bolivia and Brasil. *B.S.G. La Paz* 3 (1901): 442–446. **Munoz.**

La cuestión de Límites con el Brasil. By Juan L. Muñoz. *With Map.*

Brazil. *Popular Sci. Monthly* 60 (1902): 387–412. **Branner.**

The Palm Trees of Brazil. By Prof. John C. Branner. *With Illustrations.*

Brazil. *B.S.G. La Paz* 3 (1901): 525–527. **Idiaquez.**

Linea geodésica Madera-Yavary. Por Eduardo Idiaquez.

Gives the exact measurement of the line as deduced from the observations of the recent boundary commission, combined with previous data.

Brazilian Guiana. **De la Blache.**

La Rivière Vincent Pinzon. Étude sur la cartographie de la Guyane. Par P. Vidal de la Blache. (Université de Paris. Bibliothèque de la Faculté des Lettres, xv.) Paris: F. Alcan, 1902. Size 10 × 6½, pp. 116. *Maps. Price* 6 *fr. Presented by the Author.*

This will be the subject of a note.

Central America. **Sapper.**

Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 285–302.

Die geographische Forschung in Mittel-Amerika im 19. Jahrhundert. Von Dr. Karl Sapper.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia. **Moore.**

The Constitution of the Commonwealth of Australia. By Mr. Harrison Moore. London: John Murray. 1902. Size 9 × 6, pp. xx. and 396. *Price* 16*s. net. Presented by the Publisher.*

The author, who is Dean of the Faculty of Law in the University of Melbourne, traces the history of Australian Federation, showing the forces which have tended to bring about its realization, and then discusses in detail the constitution of the Commonwealth, and compares it with those of other countries. He evidently writes with full knowledge of the subject.

Australia. **Thomson.**

The Climate and Artesian Waters of Australia. By J. P. Thomson. (From *Queensland Geographical Journal*, No. 3, New Series, vol. xvii. 1902.) Size 9½ × 6½, pp. 32. *Presented by the Author.*

Australia. ——

Commercial Australia in 1900. Area, Population, Production, Railways, Telegraphs, Transportation Routes, Foreign Commerce, and Commerce of the United States with Australasia. (From the Summary of Commerce and Finance for November, 1901.) Treasury Department, Bureau of Statistics. Size 11½ × 9½, pp. 1835–1904. *Presented by the Philadelphia Commercial Museums.*

Queensland. *Rev. of Reviews for Australasia* (1901): 161–186. **Traill.**

Queensland at the beginning of the Century. By W. H. Traill. *Illustrations.*

Samoa. **Deeken.**

Manuia Samoa! Samoanische Reiseskizzen und Beobachtungen. Von Richard Deeken. Oldenburg, etc., G. Stalling. (Not dated.) Size 7½ × 5, pp. viii. and 240. *Illustrations. Price* 5*s.*

Based on observations during a recent visit to Samoa, this little book is useful as giving an idea of the state of things in the islands after a year of German rule. The author thinks that the long-standing feuds are now in a fair way to be composed, and assigns the merit for this to the wisdom and tact of the governor, Dr. Solf. He describes the steps which have been taken to give the natives a share in the management of their own affairs, and gives a forecast of the future of Samoa, of the importance of which, as a centre of German trade in the Pacific, he has a high opinion.

Western Australia. *R.G.S. Australasia (Victoria)* 19 (1901): 10–16. **Le Souëf.**

Notes of a visit to Western Australia. By W. H. Dudley Le Souëf. *Illustrations.*

POLAR REGIONS.

Antarctic—Climate. **Supan.**
Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 45–53.
Das antarktische Klima. Von Prof. Dr. A. Supan.

Antarctic—Exploration. *Popular Sci. Monthly* **60** (1902): 209-217. **Gregory.**
Antarctic Exploration. By Prof. J. W. Gregory. *With Maps.*

A sketch of the history of ideas respecting an antarctic continent, and of the work to be done by the present expeditions.

Antarctic—Geology. **Philippi.**
Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 33–44.
Die geologischen Probleme der Antarktis. Von Dr. Emil Philippi.

Antarctic—German Expedition. *Z. Ges. Erdk. Berlin* **36** (1901): 165–218. **Baschin.**
Die Deutsche Südpolar-Expedition. Von Otto Baschin. *With Plates. Also separate copy, presented by the Author.*

Antarctic—German Expedition. *Z. Ges. Erdk. Berlin* (1902): 66–77. **Drygalski.**
Von der Deutschen Südpolar-Expedition. Allgemeiner Reisebericht von E. von Drygalski.

Antarctic—German Expedition. **Neumayer.**
Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 3–32.
Zweiter Thätigkeitsbericht der Deutschen Kommission für die Südpolar-Forschung. Vom i. Vorsitzenden der Kommission, Prof. Dr. G. von Neumayer.

Arctic. **Cook.**
The People of the Farthest North. By Frederick A. Cook. M.D. [From *Everybody's Magazine*, January, 1902, pp. 19–33.] Size 9½ × 7. *Illustrations. Presented by the Author.*

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Cartography. *Scottish G. Mag.* **18** (1902): 34–39. **Bartholomew.**
The Philosophy of Map-making, and the Evolution of a great German Atlas. By J. G. Bartholomew. *With Portraits.*

Longitude. *Nautical Mag.* **71** (1902): 116-118. **Goodwin.**
Longitude by Equal Altitudes. By H. B. Goodwin, M.A.

Longitude. *Nautical Mag.* **71** (1902): 11–15. **Hall.**
Longitude by Equal Altitudes near Noon at Sea. By William Hall.

Surveying Instruments. **Hammer.**
Der Hammer-Fennel'sche Tachymeter-Theodolit und die Tachymeterkippregel zur unmittelbaren Lattenablesung von Horizontaldistanz und Höhenunterschied. Beschreibung und Anleitung zum Gebrauch des Instruments. Erste Genauigkeitsversuche. Von Dr. E. Hammer. Stuttgart: Konrad Wittwer, 1901. Size 10½ × 8½, pp. 52. *Plates. Presented by the Publisher.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Coasts. **Wheeler**
The Sea Coast. (1) Destruction. (2) Littoral Drift. (3) Protection. By W. H. Wheeler. London: Longmans & Co., 1902. Size 10 × 6, pp. xii. and 362. *Illustrations. Price 10s. 6d. net. Presented by the Publishers.*

This will be reviewed elsewhere in the *Journal*.

Geological History. *Sitzb. A.W. Wien* **109** (Ab. I.) (1900): 811–857. **Hoernes.**
Die vorpontische Erosion. Von R. Hoernes.

Geological Maps. *J. Geology* **9** (1901): 708–717. **Eckel.**
The Formation as the Basis for Geologic Mapping. By Edwin C. Eckel.

Geology. **Jukes-Browne.**
The Student's Handbook of Stratigraphical Geology. By A. J. Jukes-Brown. London: E. Stanford. 1902. Size 8 × 5½, pp. xii. and 590. *Maps, Diagrams, and Illustrations. Price 12s. net. Presented by the Publishers.*

A valuable feature in this text-book is the attempt to reconstruct the geography of the successive periods represented by the geological formations, which are treated not

merely as isolated groups of strata, but in their relations to past and still existing surface features. The scope of the book is, however, almost entirely limited to the British isles, except in cases where some knowledge of continental geology is necessary to a proper understanding of the changes that took place in Britain.

Geology—Surface Soil. *Science* 15 (1902): 33–35. **Means.**
On the Reason for the Retention of Salts near the Surface of Soils. By T. H. Means.

Glacial Epoch. *Geolog. Mag.* 9 (1902): 59–62. **Coleman.**
The Relation of Changes of Level to Interglacial Periods. By Prof. A. P. Coleman.

Glacial Epoch. *Die Natur* 50 (1901): 601–603. **Roth.**
Einige Worte über die Eiszeit. Von Dr. E. Roth.

Glacial Epoch. *J. of T. Victoria I.* 33 (1901): 393–418. **Upham.**
The Divisions of the Ice Age. By Warren Upham.

Glacial Erosion. **Günther.**
Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 188–204.
Der gegenwärtige Standpunkt der Lehre von der Glacial-Erosion. Von Prof. Dr. S. Günther.

Seismology. *Sitzb. A. W. Wien* 109 (Ab. I.) (1900): 700–767. **Knett.**
Mittheilungen der Erdbeben-Commission der Kaiserlichen Akademie der Wissenschaften in Wien. XX. Ueber die Beziehungen Zwischen Erdbeben und Detonationen, von J. Knett. Ditto, XXI. Bericht über das Detonations-phänomen im Duppauer Gebirge am 14. August, 1899, von J. Knett. *With Map and Diagram.*

Terrestrial Physics. **Spitaler.**
Die periodischen Luftmassenverschiebungen und ihr Einfluss auf die Lagenänderungen der Erdachse (Breitenschwankungen). Von Dr. Rudolf Spitaler. (Dr. A. Petermanns Mitteilungen. Ergänzungsheft, Nr. 137.) Gotha: Justus Perthes, 1901. Size 11 × 7½, pp. 52. *Map. Price* 4m.

Zoo-Geography. **Pratt.**
Mem. and P. Manchester Lit. and Philosoph. S. 45 (1900–1901): No. 14, pp. 21.
Some Notes on the Bipolar Theory of the Distribution of Marine Organisms. By Edith M. Pratt, M.SC.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Discovery. **Grosvenor.**
The Geographic Conquests of the Nineteenth Century. By Gilbert H. Grosvenor. (From the Smithsonian Report for 1900, pp. 417–430.) Washington: 1901. Size 9½ × 6½. *Maps.*

Ethnology—Stone Age. **Giglioli.**
Materiali per lo studio della "Età della Pietra" dai tempi preistorici all' epoca attuale. Origine e sviluppo della mia collezione. Per Enrico Hillyer Giglioli. Firenze, 1901. Size 10 × 7, pp. 218. *Illustrations. Presented by the Author.*

Historical. **Errera.**
Prof. Carlo Errera. L'epoca delle grandi scoperte geografiche. Milano: Ulrico Hoepli, 1902. Size 7½ × 5, pp. xvi. and 432. *Maps and Illustrations.*

A concise and instructive sketch, not only of the great discoveries of the fifteenth and sixteenth centuries, to which the title might suggest the book to be limited, but of the gradual extension of knowledge during the middle ages by which the way was prepared for those discoveries. There are various sketches of famous maps, such as those of Fra Mauro, Juan de la Cosa, Diego Ribeiro, etc.

Historical. *Petermanns M.* 47 (1901): 271–275. **Wieser.**
Die älteste Karte mit dem Namen "America" a. d. J. 1507 und die Carta Marina a. d. J. 1516 des Martin Waldseemüller. Von Prof. Dr. Fr. R. v. Wieser.

See article by Mr. Soulsby in the February *Journal.*

History of Discovery. **Cucalón.**
B.S.G. y Estadistica Rep. Mexicana 4 (1897–): 239–245.
Factores que más han contribuido á los descubrimientos geográficos. Por el señor General Inocencio Cucalón.

BIOGRAPHY.

Bory de St. Vincent. *B.S.R.G. d'Anvers* **25** (1901): 523–550. **Donnet.**
Deux lettres de Bory de Saint-Vincent. Par M. Fernand Donnet.

The letters were written in 1803, when St. Vincent was returning from his sojourn in various African islands.

D'Albertis. *Deutsche Rundschau G.* **24** (1902): 182–184. ———
L. M. D'Albertis. *With Portrait.*

Le Conte. *Sierra Club B.* **4** (1902): 1–11. **Soulé.**
Joseph Le Conte in the Sierra. By Frank Soulé. *With Portrait and Plate.*

Maunoir. *La G., B.S.G. Paris* **5** (1902): 1–4. ———
Charles Maunoir (1830–1901). *With Portrait.*

Murray. *Deutsche Rundschau G.* **24** (1901): 135–136. **Wolkenhauer.**
Sir John Murray. Von W. Wolkenhauer. *With Portrait.*

GENERAL.

Bibliography. **Baschin.**
Bibliotheca Geographica. Herausgegeben von der Gesellschaft für Erdkunde zu Berlin. Bearbeitet von Otto Baschin. Band vii. Jahrgang, 1898. Berlin: W. H. Kühl, 1901. Size 9 × 6, pp. xvi. and 478.

This volume contains about 9900 entries.

Bibliography. **Hamy.**
Publications Scientifiques de M. le Dr. E.-T. Hamy. Paris: Imp. Nationale, 1901. Size 9½ × 6½, pp. 28.

British Empire. **Heiderich.**
Das Wachstum Englands. Wirtschaftsgeschichtliche Skizze von Dr. Jean Heinrich Heiderich. Cassel: Gust-Klaunig, 1901. Size 9 × 6, pp. 66.

A careful study of the growth of the British Empire, the modern development of trade rivalry between the great world-empires, and the movement towards a closer commercial union between the component parts of Greater Britain.

British Empire. ———
The British Empire Series. Vol. 5, General. London: Kegan Paul, Trench, Trübner & Co., 1902. Size 8½ × 5½, pp. xx. and 682. *Maps. Price 6s. Presented by the Publishers.*

Like other volumes of the series, this is the outcome of lectures delivered at the South Place Institute, Finsbury, between 1895 and 1898, by experts in the various subjects treated of. Other articles, however, appear to have been added, for a publishers' note speaks of the delay occasioned by the transmission of proofs to writers of articles in all parts of the world. This delay has been somewhat unfortunate, as the articles are in many cases necessarily somewhat behind the time, but, taken as a whole, the volume, which is the last of the series, contains much interesting and instructive matter on questions affecting the prosperity of the Empire.

Consular Reports—Index. ———
Index to Reports of His Majesty's Diplomatic and Consular Representatives Abroad on Trade and Subjects of General Interest (with Appendix), 1898–1899. London: Eyre & Spottiswoode, 1902. Size 9½ × 6, pp. 192. *Price 9d.*

Education. **Bludau.**
Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 124–130.
Was gehört aus der Projektionslehre auf die Schule? Von Prof. Dr. A. Bludau.

Education. *G. Teacher* 1 (1902): 61–67. **Geikie.**
The Use of Ordnance Maps in Teaching Geography. By Sir Archibald Geikie, F.R.S.

Malaria. *P.R.I.* **16** (1901): 295–313. **Ross.**
Malaria and Mosquitoes. By Major Ronald Ross.

Photography—Diary. ———
Wellcome's Photographic Exposure Record and Diary, 1902. London: Burroughs, Wellcome & Co. Size 5½ × 3½, pp. 84. *Illustrations. Presented by the Publishers.*

Messrs. Burroughs & Wellcome have issued a handy pocket-book and diary for the

use of photographers. Besides the ample space allowed for the record of exposures with the details necessary as a guide to proper development, it contains a useful series of instructions, with tables of data for the use of photographers in various parts of the world, the question of exposure under the most varying conditions being fully dealt with.

Place-names. *Riv. G. Italiana* 8 (1901): 633-636. **Ricchieri and Marinelli.**

Toponomastica e Topolessigrafia. G. Ricchieri e O. Marinelli.

Royal Asiatic Society. **Cust.**

Some Remarks on the Royal Asiatic Society of Great Britain and Ireland, 1901. I. Narrative of Constitution, and Proceedings since the year of our Jubilee, 1873, to the end of the century. II. Suggestions for the Future. By Robert Needham Cust, LL.D. Hertford, 1901. Size 8 × 5½, pp. 12.

Year-book. ——

Annuaire pour l'an 1902, publié par le Bureau des Longitudes. Avec des Notices scientifiques. Paris: Gauthier-Villars. Size 6 × 4, pp. 656, 34, 92, 16, 8, and 38.

NEW MAPS.

By E. A. REEVES *Map Curator*, **R.G.S.**

EUROPE.

England and Wales. **Ordnance Survey.**

ORDNANCE SURVEY OF ENGLAND AND WALES:—Revised sheets published by the Director-General of the Ordnance Survey, Southampton, from March 1 to 31, 1902.

1 inch:—

With hills in brown or black: 2, 134 (engraved). 1*s. each.*
Printed in colours: 111, 122, 124, 125, 128, 137, 138, 139, 140, 141, 143, 144, 156, 167, 168, 178, 179. 1*s. each.*

6-inch—County Maps:—

Bedfordshire, 5 (N.W. and N.E.), 6 S.E., 7 S.E., 9 N.W., S.W., 10 S.E., 28 N.W. **Cardiganshire,** 1 S.W. **Derbyshire,** 62 N.E., 63 N.W. **Huntingdonshire,** 16 S.E., 20 N.W., 25 S.E. **Merionethshire,** 47 S.E., 48 S.W. **Monmouthshire,** 4 S.W., S.E., 6 N.E., 8 S.W., 13 S.E., 19 S.W., 25 N.W., 39 N.W., N.E., S.W. **Montgomeryshire,** 25 S.E. **Staffordshire,** 38 S.W., 53 N.E., 54 N.W. **Wiltshire,** 63 S.E., 72 S.E., 77 N.E. 1*s. each.*

25-inch—County Maps:—

Cambridgeshire, III. 8, 12; IV. 9, 13, 14; VII. 13; XII. 3, 7, 11; XXI. 5, 6, 7, 13; XXVIII. 8, 11, 12, 15; XXXII. 16; XXXIII. 2, 3, 5. **Dorsetshire,** XXIII. 9, 10, 13, 14; XXXII. 3, 4, 7, 8, 12, 16; XLII. 3, 7, 8, 11, 12, 16; XLIV. (3 and 4), 13. **Gloucestershire,** VI. 15; VII. 12; XIII. 2, 3, 4, 9, 10, 11, 15, 16; XIV. 1, 3, 4, 5, 6, 7, 11, 12, 13, 16; XV. 1, 10, 11, 13; XXI. 4, 9, 10, 15; XXII. 1; **Huntingdonshire,** XIX. 8, 11, 12, 15; XXII. 16; XXIII. 2, 3, 5. **Montgomeryshire,** XV. 15; XVI. 13; XXI. 16; XXII. 7, 9; XXIII. 1, 2, 3; XXVIII. 4, 8, 12, 13, 14, 15, 16; XXXIII. 9; XXXIV. 8, 13, 14; XXXV. 1, 2, 3, 4. **Shropshire,** XV. 9; XX. 8; XXIII. 16; XXVII. 16; XXVIII. 16; XXX. 16; XXXIII. 10, 11; XXXV. 2, 4, 6, 7, 10, 11; XXXVI. 1, 5, 6. **Staffordshire,** XLIII. 14; XLIV. 12; XLV. 2, 3, 4, 5, 6, 7, 9, 11, 13, 16; XLVI. 9. **Warwickshire** (**Det.**), LIII. 12. **Worcestershire and** (**Do. Det.** Nos. 3, 4, and 5); XLIX. 15; LI. 12; LII. 13; LVI. 2, 3; LVII. 1, 2, 3, 4, 5, 6, 7, 11, 12, 13, 16; LVIII. 1, 2, 10, 11; LXI. 4. **Yorkshire,** CCC. 7. 3*s. each.*

4 miles to 1 inch:—

Hill shaded map, printed in colours, in sheets (1 and 2), 3, 4. 1*s.* 6*d. each.*
District Maps:—With roads printed in colour (Manchester and Liverpool), 1*s.*, folded in cover or flat in sheets.

Petty Sessional Divisions in colour:—

Herefordshire, Rutland. 6*d. each.*

2-inches to 1 mile:—

Jersey, map of, printed in colours, 1*s.*; folded in cover or flat in sheets.
(*E. Stanford, London Agent.*)

England and Wales. **Bartholomew.**

Reduced Ordnance Survey of England and Wales. Scale 1 : 126,720 or 2 stat. miles to an inch. Sheet 4: Durham. J. Bartholomew & Co., Edinburgh, 1901. *Price 2s. Presented by the Publishers.*

ASIA.

Indian Government Surveys. **Surveyor-General of India.**

India, showing railways with stations, 1899, 32 miles to an inch. 1901. 6 sheets. —Indian Atlas, 4 miles to an inch. Sheets: 49 N.W., parts of districts Rohtak, Hissar, Karnál and Delhi, and of Native States Jind, Dujana, and Loharu (Punjab), 1898; 51 S.E., parts of Native States of Bundelkhand, Datia, Gwalior (C.I. Agency), etc., Jhalawar (Rájputána Agency), 1900; 86 S.E., part of district Bahraich (Oudh) and of Nepal, 1899.—Lower Provinces Revenue Survey, 1 mile to an inch. Sheets: 1A, district Purnea, additions to boundaries, 1897, 1901; 3, 8, district Purnea, with additions to boundaries and railways, 1897, 1900–1; 9, district Purnea, with additions to boundaries, 1897, 1901; 13 and 14 (2nd edit.), district Monghyr, with additions to boundaries, 1897, 1901; 15, district Purnea, with additions to boundaries and railways, 1897, 1901.—Bengal Survey, 1 mile to an inch. Sheet 164, district Cuttack, Season 1894–95, 1901.—Punjab Survey, 1 mile to an inch. Sheets: 81, 82, 83, districts of Ráwalpindi, Jhelum, and Shahpur, Seasons 1855–56 and 1856–57, 1901.—Burma Survey, 1 mile to an inch. Preliminary edition; sheets 147 and 194 (New Series), district Schwebo, Season 1892–3, 1901; 2nd edition, sheets 72 and 113, district Minbu, Seasons 1891–93 and 1896–98, 1901; 353 (new series), district Thâton, Seasons 1892–97, 1901. —Upper Burma Survey, 1 mile to an inch. Preliminary edition, sheet 385, Southern Shan States, Season 1897–98, 1900; 2nd edition, sheet 294, parts of districts Yamèthin and Meiktila, and of Southern Shan States, Seasons 1893–94 and 1898–99, 1901.—Central India and Rájputána Survey, 1 mile to an inch. Sheets: 144, part of Udaipur Native State (Rájputána Agency), Seasons 1877–78 and 1879, 1901; 168, parts of district Merwara and Native State of Udaipur (Rájputána Agency), Season 1871–72, 1900; 211, parts of Indore, Rutlam, Sailána, Jhábua (C.I. Agency), and of Kusalgarh (Rájputána Agency), Season 1879–80–81, 1900; 235, parts of Udaipur and Bundi (Rájputána Agency), Holkar (Indore), Gwalior (Sindhia) (C.I. Agency), Season 1870–71, 1901; 418, parts of Native States Bijáwar, Charkhari, Panna, and Tehri (C.I. Agency), Seasons 1855–56, 1860–62, and 1870–71, 1901; 466, parts of Native State of Rewah (C.I. Agency), Seasons 1865–66–67–68, 1900.—Hyderabad Survey, 1 mile to an inch. Sheet: 210, part of Khamamet Circar (Nizam's Dominions), Seasons 1827–28 and 1837–38, 1891.—Sind Survey, 1 mile to an inch. Sheets: 12, 31, district Karachi, Seasons 1896–97 and 1897–98, 1900.—N.W. Trans-Frontier Series, 8 miles to an inch. Sheet: 14 N.E. (Baluchistán), Seasons 1884–85 and 1898–99, 1900.—Index to the Standard Sheets of the Punjab, 52 miles to an inch. Additions to 1899, 1901. *Presented by H.M. Secretary of State for India, through the India Office.*

Philippine Islands. **Greely.**

Progress Map of Signal Corps Telegraph Lines and Cables in the Military Division of the Philippines. Prepared under the direction of Brigadier-General A. W. Greely, Chief Signal Officer U.S. Army. Scale 1 : 887,040 or 14 stat. miles to an inch. 2 sheets. *Supplement to the National Geographic Magazine*, January, 1902.

This is a roughly executed outline map of the Philippine islands, with no attempt at hill shading. However, the information it contains will be very useful. It shows military telegraph lines and cables, the eastern extension of the Australasia and China Telegraph Company's cable, commercial and military telegraph stations, telephone stations, open ports, coastwise ports, lighthouses, and post-offices. A table is also given of the military cables. There are three insets, the principal being a plan of the environs of Manila. The map is published as a supplement to the *National Geographic Magazine* for January, 1902.

AFRICA.

Africa. **Intelligence Division, War Office.**

Africa. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Sheets: 45-B, Salmia; 66-C, Roseires; (Provisional) 78-C, Akobo; (Provisional) 78-L, Musha; 78-P, Mt. Lubur; 79-I, Lower Omo. *Price 1s. 6d.* each. Scale 1 : 1,000,000 or 15·7 stat. miles to an inch. Sheet 61, Nikki. *Price 2s.* London: Intelligence Division, War Office. *Presented by the Director-General of Mobilization and Military Intelligence.*

Africa. **Service Géographique de l'Armée, Paris.**

Carte d'Afrique. Scale 1 : 2,000,000 or 31·6 stat. miles to an inch. Sheets 15, Cap Elba. Service Géographique de l'Armée, Paris. *Price* 1 *fr. each sheet.*

This is a new edition. With the exception of the inset plan of the ruins of Thebes, there is little on the sheet but the vicinity of Cape Elba.

Angola. **'Revista Portugal em Africa.'**

Angola. Scale 1 : 1,000,000 or 15·7 stat. miles to an inch. Supplement to the *Revista Portugal em Africa*. 8 sheets. *Price* 14*s*.

This map appeared in sheets as a supplement to the 'Revista Portugal em Africa' during last year. It is a rough production, but in some parts a good deal of information is given, although in others it is already considerably out of date. During the past year the reports of the expeditions of Captain Lemaire along the Congo-Zambezi watershed, and of the members of Major Gibbons's expedition in the region of the upper Zambezi and its tributaries, have been published. Much new information was gained from these expeditions, but this evidently was made public too late to be included in this map, which in these parts must not be considered at all up to date.

Transvaal. **The Chartographic Company.**

New Map of the Witwatersrand Goldfields, compiled by the Chartographic Company from the latest Official and Private Surveys and Reports. Scale 1210 yards to 1 inch. London: The Chartographic Company. Two sheets. *Presented by the Publishers.*

One of the many coloured plans that have appeared showing mining properties, with their names, reefs, railways, roads, farm-boundaries, and other information.

West Africa. **Wallach.**

A Map of the Gold Coast, with part of Ashanti and the Ivory Coast. By Henry Wallach, F.R.G.S. Scale 1 : 253,440 or 4 stat. miles to an inch. Second edition. London: E. Stanford, 1902. Six sheets. *Price* £1 6*s*. *Presented by the Author.*

This is the second edition of a large-scale map of the Gold Coast and adjacent territories which first appeared in 1900. Since that date considerable progress has been made with the survey of the colony, necessitating many additions and alterations, which appear to have been carefully made. There has hardly been time to make use of the map of Lake Busumchwi and neighbourhood, from a survey by Mr. Malcolm Fergusson, which appeared in the *Geographical Journal* for March last, but this will no doubt be done in another edition. In addition to fresh routes, rivers, villages, etc., some hill-work is now shown, and many altitudes are given in figures which do not appear on the earlier edition. There are also many useful and important notes descriptive of the character of the country. The map, which formerly extended to the west only as far as about 3° 10′ W. long., has now been carried on, by the addition of two half-sheets, to 3° 50′ W. long., and thus includes part of the French territory of the Ivory Coast. It is published in two forms, one showing physical features and political boundaries only, and the other with the gold-mining properties marked in red.

AUSTRALIA

Western Australia. **Campbell & Becher.**

Topographical Map of Kalgoorlie, based on Tacheometric Surveys. By W. D. Campbell, A.M.I.C.E., F.G.S., and the late S. J. Becher, M.E. Scale 1 : 7920 or 8 inches to one mile. Geological Survey of Western Australia, 1901. Four sheets. *Presented by the Agent-General for Western Australia.*

A large-scale mining map, showing claims with names. Contour-lines in brown, at 10-feet intervals, are laid down. Later on an edition is to be published with geological colouring, but the present one is in outline only.

GENERAL.

World. **Bartholomew.**

The International Student's Atlas of Modern Geography. A series of 105 Physical, Political, and Statistical Maps, compiled from British and Foreign Surveys, and the latest results of international research, under the direction of J. G. Bartholomew, F.R.S.E., F.R.G.S., etc. London: George Newnes, Limited. *Price* 6*s*. *Presented by the Publishers.*

The great advance that is being made in educational geography is evidenced by this school atlas, which has been published under the superintendence of Mr. J. G.

Bartholomew, and which, for its price, six shillings, is a remarkably cheap production. It is clear that there has been a good deal of careful consideration in its preparation, and the arrangement of the maps appears to have been governed by a definite principle. In this respect the atlas contrasts most favourably with many cheap school atlases, which contain nothing more than a collection of roughly executed and most confusing political maps, either reduced by photography from those on a much larger scale, with the result that the names are too small to be legible, or selected from those that happened to be already in the publisher's stock, without any regard to their educational suitability. Importance has been given to physical geography, and before the maps of each continent or country, there are in many instances maps showing the geology, relief, rainfall, vegetation, etc. In addition to the larger-scale general maps of the world, there are fourteen smaller half-page maps, showing isothermal lines, winds, rainfall, tides, races of mankind, prevailing religions, density of population, equidistant costal lines, and a time-chart of the world, showing the times at places in different longitudes corresponding to mid-day at Greenwich. With the exception of one or two of these, which are on Mercator's projection, these are on Gall's cylindrical projection, which is hardly the best for educational purposes, as it does not preserve the true configuration of the land, nor give a correct idea of relative areas. The British Isles are very fully represented by the following maps: a bathy-orographical map of the British Isles, which includes also the whole of the North sea and adjacent coast of the continent of Europe; vegetation and geological maps; four small maps showing rainfall, and tidal flow, river-basins, January and July isotherms, railways, and population. After these come general political maps of England, Scotland, and Ireland, each of which is accompanied by larger-scale maps showing relief by contour-lines and colour-tinting. Throughout the atlas, the vegetation maps are worthy of special attention, and give a very good idea of the characteristic vegetation of any particular region.

There are one or two points that ought perhaps to have received greater attention, such as the scales of the maps and the proportion that the maps of one country bear to each other. It would have been better, too, if the natural scale of each map had been given, which, as far as possible, should have been certain multiples of 1 : 1,000,000. Plate 1, giving examples of a few principal projections, will doubtless be instructive so far as it goes, but this subject might with advantage have been treated more fully. In another edition it might be well to have a sheet showing different methods of representing topographical features, with special remarks on contour-lines, vertical sections, scales of maps, etc. As might have been expected from Mr. Bartholomew, the maps are well executed: on the whole great judgment has been shown in the selection of colours, and the printing is good. The atlas also contains an alphabetical list of countries indicating the maps in the atlas on which they are shown, a list of geographical terms, another of the principal explorers of the world, and a useful index. As the maps are printed on both sides of the sheets, the atlas is not bulky, notwithstanding the great amount of information it contains. Some of the maps have already appeared in other atlases, but these have been revised, and, on the whole, Mr. Bartholomew may be congratulated for having produced a remarkably good and cheap educational atlas.

World. **Stieler.**

Neue, neunte Lieferungs-Ausgabe von Stielers Hand-Atlas, 100 Karten in Kupferstich IV. Lieferung. Gotha: Justus Perthes. *Price* 60 *pf.*

The two maps in this part are new. One half of sheet No. 81 is occupied by a map of New Zealand, and the other by insets of New Guinea, Tasmania, Tahiti, Fiji islands, and other island groups of the Pacific ocean. The maps of New Zealand and Tasmania are on the scale of 1 : 5,000,000, and are both too small to be of much value. No. 93 is a useful little general map of the West Indies, on the scale of 1 : 7,500,000, with insets on enlarged scales of Jamaica, Porto Rico, Guadeloupe and Dominica, Martinique and Santa Lucia, St. Thomas, and the environs of Havana.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, January and February, 1902. *Presented by the Hydrographic Department, Admiralty.*

No. Inches.

3164 m = 6·75 England, west coast: Morecambe bay:—Barrow harbour. 2*s.* 6*d.*

109 m = {1·48, 2·9} England, east coast:—Entrance to the river Humber. (Plans:— Kingston-upon-Hull, Grimsby road.) 2*s.* 6*d.*

3165 m = 6·8 Ireland, west coast:—Bantry and Glengariff harbours. 2*s*. 6*d*.
3217 m = 6·75 North America. Newfoundland, east coast:—Pilley island harbour. 1*s*. 6*d*.
3167 m = 3·9 Cuba, north coast:—Puerto Padre. 2*s*. 6*d*.
1324 m = 0·07 South America, east coast:—Buenos Aires to Cape Dos Bahias. 2*s*. 6*d*.
3162 m = 2·0 British Columbia:—Discovery passage. 2*s*. 6*d*.
3178 m = {6·3, 6·0, 4·0} British Columbia: Plans in Discovery passage:—Gowlland harbour, Otter cove, Elk and Duncan bays. 1*s*. 6*d*.
3251 m = 7·3 Aleutian islands:—Dutch and Iliuliuk harbours. 1*s*. 6*d*.
3180 m = 0·4 Gulf of Aden and Red sea:—Straits of Bab-el-Mandeb and approaches. 2*s*. 6*d*.
3254 m = 3·25 Australia, north coast:—Norman river entrance. 1*s*. 6*d*.
3179 m = 4·9 Australia, south coast:—Plans on the south coast of Australia: Starvation boat harbour. 1*s*. 6*d*.
3189 m = 0·5 Australia, south coast:—Cape Le Grande to Cape Pasley. 2*s*. 6*d*.
1719 Italy, west coast. New plans:—Giannutri isle, Gergona island, Pianosa island.
911 Plans of anchorages between Borneo and New Guinea. Plans added:—Wei Pelau and Awa anchorages.
979 Pacific islands:—Between 160° E. and 150° W. long. New plan:—Pleasant island. Plan added:—Ocean island.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.	Cancelled by	No.
421 Plan of Pilley island, harbour, and approaches on this sheet.	New plan. Pilley island harbour	3217
418 Plan of Port Padre on this sheet.	New plan. Puerto Padre	3167
1324 Rio de la Plata to Rio Negro. 1288 Rio Negro to Cape Three Points.	New chart. Buenos Aires to Cape Dos Bahias	1324
580, 2870 Plan of Otter cove on these sheets. 2067 Plans of Gowlland harbour, Duncan bay and Quathiaski cove on this sheet.	New plans. Otter cove, Gowlland harbour, and Duncan bay on this sheet	3178
1457 Plan of Iliuliuk harbour on this sheet.	New plan. Dutch and Iliuliuk harbours	3251
1807 Norman river entrance. Plan on this chart.	New plan. Norman river entrance	3254

Charts that have received Important Corrections.

No. 1188, The World:—Coal and telegraph chart. 2253, England, south coast:—Dartmouth harbour. 2682, Bristol channel:—Nash point to New passage. 122, Netherlands:—Mouths of the Maas. 2322, Netherlands:—Zuyder Zee. 1971, Norway approaches to Trondjem. 863, Labrador:—Hudson bay and straits. 2806, United States, east coast:—Charlestown harbour. 472, Haiti or San Domingo:—Harbours and anchorages on the coast of. 2259, Colombia:—Savanilla harbour. 1319, Chile:—Conception bay. 22, Persian gulf:—Kuweit harbour. 2757, Banka strait to Singapore. 942B, Eastern archipelago:—Eastern portion. 1602, China, north-east coast:—Approaches to the Yang-tse Kiang. 1601, China, north-east coast:—Wusung river. 857, China, north coast:—Kian chau bay. 358, Japan:—West coast of Kiusiu and Nipon. 1055, Australia, west coast:—Bedout island to Cape Cuvier. 2731, Australia, south coast:—Geelong harbour. 1670A, Australia, east coast:—Moreton bay, sheet 1. 2766, New Guinea, north-east coast. 979, Pacific islands between 160° E. and 150° W. long.:—Plan of Manahiki on this sheet.

North Atlantic Ocean and Mediterranean Sea. **Meteorological Office, London.**

Pilot Chart of the North Atlantic and Mediterranean for March and April, 1902. London: Meteorological Office. *Price* 6*d*. *Presented by the Meteorological Office, London.*

Russian Charts. **Chief Hydrographic Department, Ministry of Marine, St. Petersburg.**

Arctic Ocean.

No.
576 Chart of Yugorski strait. Scale 1·15 stat. mile to an inch. 1901.

Black Sea.

550 Plan of Novorossisk harbour and port. Scale 420 feet to an inch. 1901.

North Pacific Ocean.

568 Plan of Berevinskaia bay, Kamchatka. Scale 2030 feet to an inch. 1901.
Presented by the Chief Hydrographic Department, Ministry of Marine, St. Petersburg.

United States Charts. **United States Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for April, 1902. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

China. **Parsons.**

Eighteen Photographs of China from Hankau to Canton. [By W. Barclay Parsons, Esq., 1901. *Presented by W. Barclay Parsons, Esq.*

Taken by Mr. Barclay Parsons, an American engineer, during his recent survey for a proposed railway between Hankau and Canton—

(1) Coolies carrying coal from mines to river; (2) Ricefields and farm building in the Lu valley; (3) Rafts on the Tung-ting lake; (4) Pottery works; (5) Water-gate at Hankau, at the junction of the Han and Yang-tse rivers; (6) Farm buildings in Eastern Hunan; (7) Gateway and street in Hu; (8) Li-ling cantilever bridge; (9) Hunan farm of the better class; (10) Kwangtung village and pawnshop; (11) Bridge below Chiling Pu; (12) Sandstone cliffs west of Wa Yao Ping; (13) Che-ling highway; (14) Yu-tan river, Nan-ling mountains in distance; (15) Mr. Barclay Parsons and party; (16) Siang river at entrance to Tung-ting lake; (17) Low-water channel of the Siang river through Tung-ting lake, showing alluvial deposit; (18) Rafts on the Tung-ting lake.

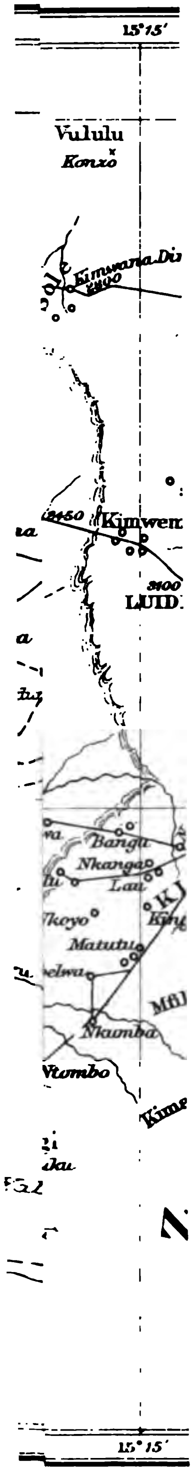
Peru. ——

Seventeen Photographs of the Inambari river and neighbourhood, 1901. *Presented by the Ministerio de Fomento, Lima, Peru.*

The Inambari is a tributary of the Madre de Dios in the department of Puno, Peru. The course of the river and the region through which it flows are but very imperfectly known; hence these photographs have a special interest. The following is a list of the titles:—

(1) View of the Inambari; (2) View of the Inambari below its junction where it receives the Chaspa; (3) Confluence of the San Gaban and the Inambari; (4) Crossing the San Gaban by means of an improvised bridge; (5) Natives spearing fish; (6) Members of the expedition before starting for the mountains; (7) Quepiris on the way to the mountains; (8) Quepiris preparing to depart for Llinquipata; (9) Arrival of porters (Quepiris) at Lliuquipata; (10) View in the highlands of Macusani; (11) Llamas leaving Ayapata with baggage of the expedition; (12) Engineer F. Carbagal with the chief of a savage tribe; (13) Engineer F. Carbagal and others embarking on board a canoe at Mercedes; (14) Puerto Maria Mercedes; (15) View near the confluence of the Araza; (16) Embarking on board the canoe *Josefina Rosalva* on the Araza; (17) View of the flat country on the right of the Jaguar Mayo.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.



15°15'
Vululu
Konzo
Kimwen
LUID
Bangu
Nkanga
Lau
Matutu
Nkamba
15°15'

Russian Charts. **Chief Hydrographic Department, Ministry of Marine, St. Petersburg.**

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No.
576 Chart of Yugorski strait. Scale 1·15 stat. mile to an inch. 1901.

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550 Plan of Novorossisk harbour and port. Scale 420 feet to an inch. 1901.

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568 Plan of Berevinskaia bay, Kamchatka. Scale 2030 feet to an inch. 1901.
Presented by the Chief Hydrographic Department, Ministry of Marine, St. Petersburg.

United States Charts. **United States Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for April, 1902. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

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Seventeen Photographs of the Inambari river and neighbourhood, 1901. *Presented by the Ministerio de Fomento, Lima, Peru.*

The Inambari is a tributary of the Madre de Dios in the department of Puno, Peru. The course of the river and the region through which it flows are but very imperfectly known; hence these photographs have a special interest. The following is a list of the titles:—

(1) View of the Inambari; (2) View of the Inambari below its junction where it receives the Chaspa; (3) Confluence of the San Gaban and the Inambari; (4) Crossing the San Gaban by means of an improvised bridge; (5) Natives spearing fish; (6) Members of the expedition before starting for the mountains; (7) Quepiris on the way to the mountains; (8) Quepiris preparing to depart for Llinquipata; (9) Arrival of porters (Quepiris) at Llinquipata; (10) View in the highlands of Macusani; (11) Llamas leaving Ayapata with baggage of the expedition; (12) Engineer F. Carbagal with the chief of a savage tribe; (13) Engineer F. Carbagal and others embarking on board a canoe at Mercedes; (14) Puerto Maria Mercedes; (15) View near the confluence of the Araza; (16) Embarking on board the canoe *Josefina Rosalva* on the Araza; (17) View of the flat country on the right of the Jaguar Mayo.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.


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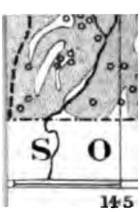

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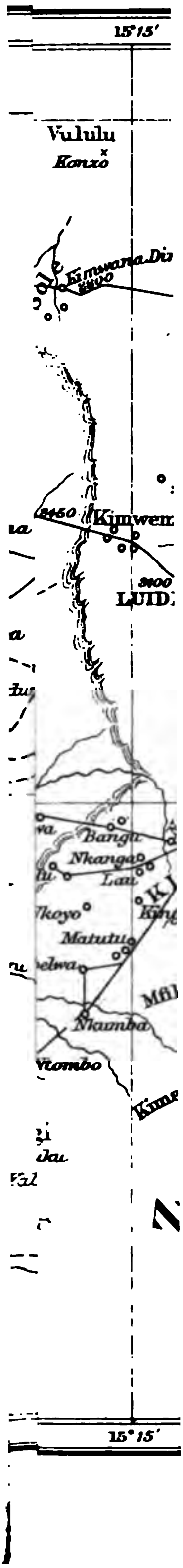
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The

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A JOURNEY FROM OMDURMAN TO MOMBASA VIÂ LAKE RUDOLF.*

By Brevet-Major H. H. AUSTIN, C.M.G., D.S.O., R.E.

On October 27, 1900, I was offered the command of a survey expedition in the Sudan, and Major R. G. T. Bright, of the Rifle Brigade, who had twice previously accompanied me in Africa, was detailed to assist me in the undertaking. The next month was employed by us in equipping the expedition, which it was anticipated would be absent from England for about a year.

On our arrival at Cairo it was decided that a medical officer should accompany the expedition, and the services of Dr. J. Garner, who was then attached for military duty to the British troops, were obtained. That was on December 10, and on the 15th he had been completely fitted out, and ready to accompany us on our journey to Omdurman. We left for Assuan by train on the night of December 15, and arrived at Khartum on the night of December 23. During the next few days Colonel Talbot handed over to us the Jehadia—some half-dozen of whom had accompanied Major Bright and me the previous year when we visited Abyssinia—our transport animals, saddles, rifles, ammunition, tents, etc., etc., and, taking three months' supply of food with us, we started on our journey up the Nile to Nasser on December 29. The gunboat *Fateh*, which was our home for the next fortnight, towed two double-decked barges and two sailing-boats, in which all our animals, men, rations, equipment, etc., were accommodated. All told, we numbered sixty-two men, including ourselves, servants, escort, and transport drivers. We proceeded without incident up the Nile, reaching Fashoda

* Read at the Royal Geographical Society, April 14, 1902. Map, p. 788.

on the night of January 6, Taufikia the next day, and thence continued up the Sobat river.

Nasser fort was reached by the expedition on the evening of January 11, and there we met Blewitt Bey, the Mudir of Fashoda, who accompanied us some 9 miles up the Sobat river the following day, to a point where it had been decided the expedition should disembark and continue the remainder of its journey by land. During the next two days all the transport animals, equipment, etc., of the expedition were landed, and the Mudir returned to Taufikia in his steamer on the morning of January 14, 1901, followed shortly after by the *Fateh* and the sandal and gyassas, which had brought us so far from Omdurman by water. We were cut off now from all communication with the outer world, of which we heard no news again until we reached the Lake Baringo post on August 2.

A start was made on the 17th, and a most unsatisfactory one it was. Following the river for a mile, we struck across country to avoid a big bend, and at once became involved in long grass, which concealed great deep cracks in the ground caused by the drying up of the swamps. Into these cracks the poor little donkeys kept constantly putting their feet, and fell down in a most helpless state. It was often necessary to dig away round their feet in order to extricate them from the cracks in which they were firmly wedged. As a result, it was past 2 p.m. before we struck the river again and were able to camp, although we had only marched some 4 or 5 miles. The camp remained halted the next day, whilst a party was despatched to bring on the food left behind. In this way, proceeding easily by double stages, we travelled along the Sobat to its junction with the Pibor, and then struck south along the latter river, very much along the route followed by Major Bright and me the previous year, to the junction of the Gelo and Pibor rivers near the village of Bil. Here the Nuer guide obtained for us by Blewitt Bey desired to return to Nasser as he feared to proceed further. Sheikh Yowe and all his people, who during the rainy season inhabit the Koratong group of villages some 8 or 9 miles south-west of Bil, had moved to the latter place for the dry season. A deputation was therefore sent to Sheikh Yowe, asking that we might be provided with a guide to conduct us to the junction of the Akobo and Pibor rivers. In accordance with our request, he sent us one of his own sons; but this man gave us the slip soon after we started next day, and we never saw him again. Having previously traversed this portion of the journey, it did not very much matter, so we continued without a guide, and had little difficulty in reaching the Pibor-Akobo junction on February 4, 1901.

We had by this time consumed our surplus food, and were able to proceed direct; and were fortunate in finding some Anuak natives settled temporarily at the river junction, two of whom consented to

guide us for a few days along the Akobo in return for presents of beads. On February 5, therefore, we started in an easterly direction along the Akobo, and two days later reached our old camping-ground of May 15, 1900, where Major Bright and I had first struck the Akobo when leaving the Gelo river. Travelling was somewhat laboured owing to the long grass not being burnt by the natives, which is always done when it has become sufficiently dry to ignite readily. Hitherto, however, we had experienced little trouble from swamps; but we were soon to encounter these formidable obstacles, which caused great delay in working round them on higher ground away from the river. Indeed, more than once we were compelled to retrace our footsteps for several miles, as we were unable to proceed in the direction we desired to. Between February 9 and 16 we were unable to camp on the river at all, owing to broad belts of swamp, which effectually prevented us approaching the stream. Every night, therefore, we were obliged to camp on the edge of this swamp, where at sundown the mosquitoes appeared in myriads, and made one long for day. We had now reached the Anuak district of Tedo, and the guides wished us to cross the river at this point, as the travelling was reported better on the north or right bank of the river. We were separated from the main stream by a thick belt of tall coarse grass a mile wide and several swampy overflow channels, so Major Bright and Dr. Garner were employed on the 16th in improving the approach to the river and the track on the far side. Thanks to this work being thoroughly well done, we had little difficulty in crossing on the 17th, and continued in an easterly direction away from the river to high ground, where large numbers of Anuak huts were dotted about midst cultivation. All the natives, however, fled at our approach, and it was almost impossible to get them to come near us, in spite of our being accompanied by several of their fellow-tribesmen from the opposite side of the river. To do our guides justice, they were the most accomplished looters I have had the pleasure of travelling with, and never hesitated for a moment, when they had the opportunity, of clearing out their own brothers' huts of all they possessed, unless prevented from doing so. Possession is most obviously nine-tenths of the law amongst these simple (?) savages.

Our next march south from Tedo was at some distance from the river, both banks of which were fringed with a broad belt of long grass and swamp as far as the village of Neum. Here we struck the river again, and camped in a most charming spot under giant sycamores, of which there was almost a forest growth along the banks. Numerous Colobus monkeys found food and refreshment here, whilst many lovely birds and butterflies added colour to the scene, which was further enhanced by the pretty cotton-plant flowers—a pleasant change from the dreary swamp land, often devoid of even a single tree, to which we had become accustomed. From this point on the country is

generally well wooded, although in many places bordering the river bank large areas of swamp exist. On February 22 we obtained our first view of a hill since we had left Nasser. This is a fine rugged isolated mountain, which attains a height of 3550 feet, and is known to the Anuaks as Ungwala. A long march of 16 miles on February 24 brought us to the foot of this hill, and we camped for the first time on gravelly soil, between it and the river.

I may here note that in Bòttego's map this mountain, called by him Ischeno, is shown on the wrong bank of the river.* The next day we discovered two small lakes during the march, most picturesque pieces of water, which I named after my two comrades, Lakes Garner and Bright. The country now became more undulating, and although in many places the river-banks were clothed with long coarse grass, we were always able to proceed without much difficulty along the higher ground overlooking the river. On several occasions we saw herds of magnificent elephants, and on two separate days were compelled to halt the whole caravan in order to allow these majestic brutes to cross our path in front of us; this they did in a most leisurely way, causing something of a panic amongst our mules and camels, who little appreciated the proximity of these lordly beasts. During our last days on the Akobo river, much delay was caused by our having to cross from one bank to the other, as our guides would only take us by routes familiar to them. Fortunately, the water was seldom over knee-deep in these upper reaches of the river; but the banks were generally steep, and had to be especially prepared for the passage of our large number of transport animals.

On February 27 we camped for the last time on the river Akobo, which here flowed from an easterly direction before turning north. I estimated we were at the point where Bòttego in his map shows the large village of Melile. Of this place, however, we could find no trace, nor was the name even known to the guides who accompanied us. For some days past we had obtained glimpses in the early mornings of the lofty Abyssinian mountains away to the east of our route, the more important peaks of which I was able to fix approximately. The highest point was over 8000 feet above sea-level, whilst others ranged between 7000 and 8000 feet. I decided at this point to leave the Akobo river (which had previously been explored for some distance further up-stream by Bòttego, whose maps were very reliable), and to strike south along a small stream known to the Anuaks as the Ajibur, which, though at this time of the year was not running, still contained small pools at intervals. A small lake was formed a mile or two above the junction of the Akobo and Ajibur rivers.

On February 28 we crossed the Akobo, and, travelling for about 3 miles in a south-westerly direction across undulating country, struck the bed of the Ajibur, which we crossed and followed approximately

for the next few days, always happily finding pools. To the west of our line of march isolated peaks sprang up at intervals, all of which were over 3000 feet in height. These and the ridge connecting them form, in my opinion, the water-parting between the Ajibur river and a stream reported by the Anuaks to exist some 15 to 20 miles to the west, which is known to them as the Neubari. Our guides had only heard of this stream, however, and had never visited it, I believe. Does such a river exist, I think it may possibly be identical with the late Captain Wellby's Ruzi II., as we had previously come across a swampy stream approaching very closely to the Akobo on February 21, which here was known to the Anuaks as the Oboth, and which they averred merely took off from the Akobo, some 10 miles distant. I have assumed in my map that the Neubari possibly enters the Oboth, and that the combined streams subsequently flow west to the Pibor, and not again into the Akobo.

On March 3 we camped for the last time in the plains before entering the hilly tract of country known as Boma. For the next few days our progress through these hills was extremely slow, as the track was in places very steep, and we were subjected to heavy rains, which not only converted the numerous little streams we had to cross into rapid mountain torrents, but also rendered the track very slippery, and in places boggy. Several streams, in fact, had to be bridged before we could cross our transport animals.

The scenery of this little mountain district was at times grand, as magnificent rocky crags and pinnacles were visible on nearly every side. The soil is an extremely fertile red loamy clay, and, I should say, capable of producing all kinds of cereals. The climate is delightful, the air being fresh and pure (as compared with the low-lying swamp land we had previously traversed); for all this country ranges from 3000 to 4000 feet above sea-level, whilst higher ridges and crags attain to almost an altitude of 6000 feet. The natives, though not unfriendly, are shy, as they are not only harassed by their more powerful neighbours to the south, such as the Magois and Karuno tribes, but the Abyssinians also pay them periodical visits. In consequence, on the approach of our caravan, they immediately concealed themselves, and it was with considerable difficulty that we eventually persuaded them that our intentions were friendly, and were able to procure a guide. On March 7 we crossed the highest ridge that the track led over, and then abruptly descended on the far side (from 3700 feet to 2600 feet) to the sloping glacis at the foot of the hills, which falls another 400 or 500 feet into the seeming dead level vast plain, extending as far as the eye could see, from the summit of the pass, away to the west—in fact, probably as far as the Nile and beyond. We now worked in a south-westerly direction to get out on to the plain, as the ground near the base of the mountain range (which ran north and south) was much

broken up, and difficult for transport animals. We almost at once passed out of the rain zone, and were very shortly confronted with a barren desert.

In spite of large herds of zebra, hartebeeste, ostriches, and gazelle roaming these plains, which seemed to point to the fact that water must be plentiful somewhere, we experienced a most anxious time regarding this precious fluid. On March 11 we passed a large pool 6 or 7 miles after starting, but as it was too early in the day to camp, we proceeded, as we hoped to find water on ahead. By 2 p.m. we had marched $17\frac{1}{2}$ miles, and were still in this burnt-up plain, and had found no traces of water. To continue with all our animals and the men showing signs of exhaustion seemed rash, as we had no one to tell us where water was likely to be found. The heat, too, had now become very great; so I decided to camp, unload all the animals to rest them, and to send off a search-party under Mabruk Effendi, accompanied by five camels and fifteen donkeys carrying saddles and water-skins. I instructed Mabruk Effendi to work in a westerly direction towards a prominent isolated craggy hill some 20 miles to the west of us, as I hoped by so doing, after marching some 7 or 8 miles, he might strike Wellby's Ruzi river No. II. The improvident men had early in the march emptied their water-bottles, but I did not feel disposed to return 10 or 11 miles along our track to the pool passed early in the day, as we should still have the difficulty regarding water ahead to face. It was a wretched afternoon, as there was not a drop of water in camp beyond what Major Bright, Dr. Garner, and I had in our water-bottles, and before long the great heat had such an effect on the men that the eyes of several of them literally appeared to bulge from their sockets.

Shortly before retiring to rest, a horrible idea seized me that we must be in the middle of the desert—where Mr. Donaldson Smith's expedition for three days had experienced such dreadful torture for want of water—in which case the Ruzi II. was here non-existent. I firmly believed then I had sent off the unfortunate search-party to their utter destruction, and could get no sleep in consequence, as none of them had returned. I sat up all night outside my tent in my chair, and as soon as the moon rose, shortly after midnight, I decided to send back another party of six men riding six donkeys, and taking all the men's water-bottles in camp, with orders to return to the pool some 10 miles distant, fill up, and come back as quickly as possible. This done, I felt at all events we could face the return journey to the pool on the morrow in the event of Mabruk Effendi and his men failing to find water, and be able, in addition, to spare a little for his exhausted party.

Morning dawned with not a cloud in sight. Anxious eyes scanned the western horizon, but not a trace of Mabruk Effendi's cavalcade could be seen. About seven, however, distant figures were observed, and through our glasses we made out camels, and later, donkeys and

men. Their progress was very slow, and it was some time before we could see sufficiently clearly that the animals were carrying heavy loads. Then our hopes were raised indeed, for we knew that water must have been found. In due course, the men and animals, all dog-tired, reached the camp. Mabruk Effendi had saved the situation by his indomitable pluck and determination, for, after a long weary search, he had come across a large swamp out on the plain, from which he had brought us gallons and gallons of water, as all the skins had been filled. We had more water than the men could drink now, for shortly after nine the other party sent back with water-bottles also arrived. We were able, in consequence, to give all the animals a taste of water each, and about 12.30 p.m. made a start for Mabruk Effendi's swamp, which fortunately proved to be only 7 or 8 miles distant. Even so, eight or ten men had so much felt the effect of being without water, that they were with difficulty got into camp before dark. It was a lesson, and a severe one; but it taught the men to be far more provident in the future regarding reckless drinking of water on the march. For what a fluke it had been that water was discovered in the direction I had indicated! Beyond that small area of swamp, it is not unlikely that no other water existed on that fearful desert plain.

We remained halted for March 13 and 14, to give men and animals ample time to recuperate, as we learnt from a small colony of natives settled on the swamp that there was a long march south before we would reach water again. Two of them consented to act as guides in return for presents of beads, so we made a fresh start on the 15th, and, after a hot tiring march of 20 miles over this dreadful plain, struck a large pool in the Karuno river shortly before dark. Our guides would proceed no further, so for the remainder of our journey to Lake Baringo, except for a few days, when we were accompanied by Suk youths when approaching that place, we were left to our own devices. I decided at first, at all events, to follow this river in an easterly direction towards the hills, where there seemed more prospect of obtaining water than out on these inhospitable plains. We crossed the river on the 16th, and on the 17th proceeded approximately along its bank, and later camped amidst a thick growth of thorn bush, in an old camp of either Dr. Donaldson Smith's or Captain Wellby's, where we obtained water by digging in the sandy bed of the nullah. We met large numbers of Karuno natives during this march, brilliantly decked out with fine ostrich feathers dyed different colours. I imagine they must be closely allied to the Magois people (first described by Dr. Donaldson Smith), who, we understood, had recently been driven further west by the powerful Turkana tribe; these had come north in force, and raided large numbers of cattle and goats and sheep, which they had succeeded in carrying off with them. The Karuno are not unfriendly, but extremely suspicious, so we had little opportunity of ascertaining much

information from them, as they stoutly refused to provide us with guides.

The country lying to the east of us consisted of a thorny plain which extended to the foot of a precipitous-looking range of hills, a veritable rocky escarpment running north and south. It seemed hopeless to attempt to climb this, so I decided to try and work round it in a southerly direction before proceeding east to our goal—Murle, on the river Omo. We struck south, therefore, on March 18, towards an isolated peak in the plain, and then turned south-east to a prominent outlying hill of the main range, where happily we found some small pools of water up on the hillside. Continuing round the foot of a rocky escarpment, generally in a south-easterly direction, next day we reached a dry khor, which seemed to promise water on digging. We were unable to find any. We had, however, sufficient water in skins to last the men for one day, so in the afternoon parties were sent out to search. One man eventually returned after dark, reporting the existence of a large pool some miles distant at the base of a large valley thickly wooded with thorn bush, and enclosed to the south by irregular ranges of hills. We were rather shut in by hills, through which I was anxious to find if a pass existed; so next day the camp remained halted, whilst Major Bright went with a party to fill our skins with water and bring it on animals to camp, and Dr. Garner I despatched to look for a pass where I thought there might possibly be one.

His report proved satisfactory; so next day, carrying water as usual, we had little difficulty in climbing the pass, and then continued as before along the foot of the rocky escarpment, until we reached a point where it abruptly ran back in a northerly direction for some 10 to 15 miles. Thence the range ran east and west and subsequently south again, forming a long narrow bay, as it were, enclosing an open plain swarming with game. We camped without water, but later ascertained the existence of a small stream with pools in the centre of this enclosed plain, to which we marched next day. On March 22 we continued in an easterly direction over an easy pass at the foot of a rocky crag, and camped some 5 or 6 miles further on in another plain, where we obtained water by digging in the sandy bed of a dry khor. From this point we obtained our first view of Mount Naita, a grand mountain mass terminating in a lofty conical peak, which attains a height of over 7000 feet. I had previously approximately fixed the position of this peak in my journey along Lake Rudolf in 1898, as it is visible from a great distance, and for the next five or six weeks we seldom lost sight of it.

For the next two days we travelled generally in a south-easterly direction, and were fortunate in striking pools of water. Being without guides in an absolutely unknown country, we had literally to feel our way over this plain, thickly wooded with thorn bush. The anxiety

regarding water had told in some cases on the men, who appeared a bit unnerved, and performed their work in an apathetic manner, as though they anticipated disaster. For the next week we proceeded generally in a direction slightly to the north of east, through a somewhat hilly country, where the difficulties regarding water still continued, and placed us on several occasions in a most unenviable position. Fortune favoured us, however, and when affairs looked their blackest, something always turned up to relieve us of anxiety. Nevertheless, it was with no small satisfaction that, when we reached the Sacchi river on April 1, we found it a fine running stream—the first flowing water we had seen since the beginning of March, when we were in Boma country. By the irony of fate, later on the same day, when following this river we became involved in a most formidable swamp, around which we worked with considerable difficulty, and were unable to camp on the river at all. We eventually found a fairly dry spot amidst thorn bushes, and camped here near a pool.

The escarpment we had lately been skirting, I am inclined to think, must be the edge of a high-lying plateau, varying in height, probably, from 3000 to 5000 feet above sea-level. I imagine all that country to be healthy, possibly well watered and fertile, and very closely resembling Boma in general features. I am sure a most interesting field for exploration exists on those hilly regions, which we were compelled to avoid, encumbered as we were with transport animals.

For the next three or four days we followed approximately the course of the Sacchi, which was clearly marked by a broad belt of tall trees; near the river a fine forest growth existed (the haunt of numerous elephants), which made it extremely difficult to find or reach the river-bank. On April 4 we camped on an open plain, the river-bank being here free from trees or vegetation, some 7 or 8 miles to the north of Mount Nakua, a familiar landmark of our previous visit to Lake Rudolf. I now knew that probably a 20-mile march in a direction slightly south of east would bring us to the Murle district on the Omo river, and this march was successfully accomplished on April 6. On the eighth, we continued some 5 miles in an easterly direction to our well-defined camp of September 15, 1898, on which I closed my survey from the north. The result proved most satisfactory, as the new position obtained for this camp, working from Nasser as my base, agreed within half a mile of the previous position obtained by me in 1898, when working north from the Mombasa side.

Our food supply was running extremely short, in spite of our having for some time past greatly reduced the men's rations, so it was decided to proceed leisurely up the Omo, with the twofold object of buying from the natives and meeting the supplies which we hoped might be being conveyed south towards us, and were merely delayed by the heavy rains which about this time commenced. On the 9th we marched

north, into the Kerre district, halted there the 10th, but could not induce the natives to trade, so moved on again a little further north on the 11th and 12th. At the latter camp we halted for two days, but could obtain no food at all from the natives. The river-bank was extensively cultivated; but the grain was in a green condition, and would not be ripe for at least another two months. The higher we got up the river, the more backward became the crops. We now began to get extremely anxious, as we had very little food left; the natives either had none or were unwilling to barter what they had, and of the expected supplies we could learn nothing.

There was still one more chance of obtaining food, perhaps, in the Mursu district, further north again, as Dr. Donaldson Smith the previous year had purchased and reported plenty in that neighbourhood. We decided, therefore, to proceed there, and a miserable time we spent during the undertaking. We were subjected to terrific storms of rain, which converted the plain into bog, and formed shallow lakes of water all over the country, rendering our progress far from pleasant. When we reached the Omo by cross-country marches, cutting off a great bend of the river which flows in a north-easterly direction, we found ourselves confronted by most extraordinary broken ground—a bewildering labyrinth of low clay cliffs and depressions. Through this sort of country we proceeded for two days in a westerly direction, but were unable to camp on the river, which was fringed by an impenetrable forest growth, the ground being inundated with water. We struck two small lakes, on the margin of the larger of which we camped on April 19—a most picturesque sheet of water, first previously seen, I believe, by Dr. Donaldson Smith.

It was most confusing work hunting up a possible route through this broken country, and we were compelled to zigzag about in a most annoying manner in our endeavours to proceed west. The country seemed to be absolutely deserted except for a few stray natives, none of whom lived on the bank we were following; and as for food, we saw practically no signs of it, and consequently obtained none. In little over a year the country had changed from a fertile, well-populated district to a barren one. The rains continued with unabated fury, and seldom had any of us experienced such terrific storms at night as those to which we were now subjected. Our animals were beginning to show serious signs of breaking down, as the Sudan camels and donkeys are quite unaccustomed to this sort of weather.

It was obviously suicidal to proceed further north, as even here in the plains we were doing badly, and had we continued into hilly country and forest, with its attendant cold as well as rain, I felt in a short time we should lose every animal we had. I decided, therefore, to return again to Murle, to see if during our absence the food supplies had arrived. Could I get no news of them by April 25, I had made up

my mind that our only hope of salvation, seeing the extremely critical position we were placed in regarding food, was to immediately make south along the western shores of Lake Rudolf for the Ribo post, living as best we could on our transport animals. Before leaving Omdurman we had read Sir Harry Johnston's report from Uganda, in which it was stated that a post had been, or was shortly to be, established at that place. I frankly admit that I anticipated a loss of perhaps 25 per cent. of our men and about 50 per cent. of the animals in the undertaking; but in my most pessimistic mood I never imagined the dreadful loss of 75 per cent. of our personnel, which we actually suffered, nor the terrible experiences we were to undergo before reaching safety. By one long and one short cross-country march from Mursu we reached our old camp on the Omo, near where we first struck that river on April 6.

There was no news of the food supplies, so we rested on April 23 and 24. During this interval of rest, one of the transport drivers, who had been with Major Bright and me on a previous expedition, mysteriously disappeared. I have little doubt that, whilst out in charge of the donkeys when grazing, he had gone off on a marauding expedition by himself, and had been speared by the natives. Search-parties were sent out, but no trace of him was ever found, as his body had evidently been thrown into the river. Up to this time our losses in transport animals had been very slight, considering the little rest they had had. We still had 11 camels, 10 mules, and 114 donkeys; but about this time some of the camels began to sicken, and in a short time several died, probably from eating some poisonous herb.

All arrangements being completed for the journey south, we made an afternoon march on April 25, as I considered it unlikely we could accomplish a 20-mile march now to the Sacchi, owing to the soft boggy nature of the ground after the recent heavy rains. Next day we travelled well for the first 4 miles, and then became involved in a frightful bog, through which the animals were only taken with great difficulty, and on the far side of which we were compelled to camp. It occupied us the whole of the next day reaching the Sacchi, which was only done just before dark. We had taken three days to accomplish what three weeks before had only taken us one. We now found that the Sacchi had recently overtopped its banks, and the country had been converted into swamp. We travelled 3 or 4 miles along it next day in a southerly direction, and crossed to the west bank, where the going seemed to be better. We found it impossible, however, to work towards the north-west corner of Lake Rudolf, owing to the swampy nature of the country, through which our animals were quite unable to travel. For the next five or six days, therefore, we were working round this swamp at the foot of the Lorusia range of mountains, some miles away to the west of the lake. I would here remark that several powerful streams during the rainy season flow from the west into the

Sacchi river, which spills into a large area of swamp at the head of Sanderson gulf, before the shores of Lake Rudolf are actually reached. At one time it appeared extremely doubtful if we could continue south; but we were fortunately able eventually to follow a dry route, and on May 5 were camped on the bank of a khor, which I felt sure must be the one entering the lake near Lumian.

Here our first great calamity befel us, as three of our men were murdered not a mile from camp. The fact remained unknown to us until nearly 3 p.m., when news was brought into camp that a non-commissioned officer, an askari, and our cook were lying dead on the plain, having been speared by natives. The details of this treacherous attack will never be known, as the natives were not seen. On receipt of this shocking intelligence, I despatched Dr. Garner with camels and an escort of twelve men to bring in the bodies, which were buried outside camp just before dark. That night for the first time we saw a comet in the constellation of Orion, and several discussions took place amongst the superstitious ones as to whether its advent was a good or evil omen. I fancy the impression that it was an evil one for us was probably more generally favoured. At all events, that same night about 1.30 a.m., with the assistance of a full moon, a band of from forty to fifty warriors made a dash for the camp, yelling like demons as they charged. Fortunately, every man was sleeping on his post round the camp as usual, and as their nerves had been highly strung from the afternoon incident, the sentries were all on the alert and especially watchful.

As we were unable to construct a thorn zariba round the camp, the promptitude of the sentry in front of our three tents, which was the side attacked, probably saved our lives. Shouting for the guard to turn out, this man fired as he shouted, and in less time than it takes me to describe it the whole of this side of the camp were firing at the advancing foe. The latter were unable to face our rifles, and turned and fled without penetrating our line of men. It was one of the quickest and smartest pieces of work we had ever seen done, and I was very highly gratified to find the excellent fire-discipline observed by the men. There was no wild senseless waste of ammunition, and firing ceased directly the enemy disappeared, which I need hardly say is not always the case with native troops who have been suddenly alarmed at night. A second attack was also attempted by another body on the rear face of the camp, but they were easily driven back, leaving several spears which they had hurled into the camp, but which had done no damage. It now became most obvious that the natives of this district, who formerly in 1898 were quite friendly, were now bitterly hostile.

As we had never harmed them in any way, and were always most anxious to establish friendly intercourse with the natives we met, I can only think that this sudden change of feeling towards Europeans had been brought about by ill treatment subsequent to our former visit.

The following morning we marched 2 to 3 miles in an easterly direction along the khor, and reached our old camp of September 8, 1898, at Lumian. The natives dogged our footsteps and followed on our flanks to Komogul, where we camped that day on the bank of a khor, from the bed of which we obtained water near the surface. As there were large numbers of natives lurking about among the trees and bush, we made our position defensible for the night, but were left unmolested. The next day we made only a short march, and camped for the first time on a low cliff overlooking the lake. As the country was fairly open, the natives did not venture to approach too closely, although they took up prominent positions for observation purposes, screened by bush. Continuing next day, we camped near the foot of an extinct volcano, Lubur by name, and here I was taken seriously ill with gastritis, which rendered me so weak that Dr. Garner advised a halt on May 9 and 10. We started again on the 11th, and travelled in a southerly direction along the lake-shore; but I was compelled to ride a camel at the head of the column for some ten days, as I was too weak to march. The poor grazing was telling severely on our camels, who became extremely emaciated and weak, so we began to kill the sickly ones for food purposes. Their condition was so wretched that our progress on the march was dismally slow. The small ration of grain to which the men were, of necessity, restricted also began to make itself felt, and for the first time demoralization set in amongst the transport drivers. These latter gorged themselves in such a bestial manner with every portion of a camel, including the hide, feet, blood, etc., that before long several of them showed signs of breaking up. On May 19 three Jehadia (transport drivers) died, whilst a fourth, in spite of repeated orders, went outside the camp zariba shortly before midnight, and came yelling back into camp with a spear-wound through him. He was carried on a donkey for several days before succumbing.

Time after time the men had been warned that our every movement was being watched by hostile natives, who, although unseen, were always lying in wait ready to spear any stragglers who might wander from the precincts of camp unarmed. Our men, more especially the Jehadia, were visibly suffering greatly for the want of carbohydrate food, as the supply of grain issued daily as a ration was extremely limited in quantity, and on meat alone they seemed quite incapable of maintaining their strength. Our line of march was daily hampered, in consequence, by our having to mount ten or eleven men on donkeys in rear to get them along at all. The fine discipline of the regular soldiers enabled them to carry out arrangements whereby they all messed together; but the other men so little trusted each other in their present straits that they fed independently, and therefore derived considerable less benefit from their rations. Ultimately, when our losses had become so serious that there appeared grave doubts of our

ever getting through, a general mess for the whole camp was insisted on, and proved much more satisfactory. On May 22 we camped for the last time on Lake Rudolf, and next day marched across country in a southerly direction to the river Turkwell, the sandy bed of which was half a mile wide where we struck it.

I have somewhat abruptly dismissed our journey along the shores of Lake Rudolf, as I have previously written a description of that great reservoir. We found the water of the lake at a lower level than in 1898, due to the exceptional drought of the previous year, when the Omo river was quite dry. The water was far more nauseating than formerly, and the numerous lagoons we remembered as teeming with wildfowl of many varieties were to a large extent dry, and birds were conspicuous by their absence, so even this source of food was denied us; whilst big game is practically non-existent on the western shores of Rudolf, which constitute grazing-grounds for Turkana flocks and herds.

The Turkana were settled in large numbers along the Turkwell, but behaved in a most treacherous manner; although pretending friendship and conducting us some 5 miles down the bed to a water-hole, they seized the first opportunity and speared one of the donkey-corporals out on grazing guard. The man died next day. It was obviously useless trying to maintain any friendly relations with these people, which I was most anxious to do, seeing the weak state of the caravan.

In 1898 the Turkana of the Turkwell had harassed my column of 180 men, and caused much trouble and anxiety, owing to their repeated attempts on our transport animals whilst grazing. It may be imagined, therefore, that with one quarter of those numbers, and the larger majority of the men incapable of much active work, I did not at all relish the passage through their country under present conditions. There was no alternative, however, and our one chance of salvation was to exercise extreme caution, and to give as little opportunity as possible for the Turkana to do us serious damage.

We continued west along the Turkwell, marching in the bed of the river, as the banks were thickly wooded and afforded too much cover for an active foe to be pleasant for us. Daily the condition of our men became worse, and I am not using too strong an expression to describe our progress on the march as perfectly appalling. We had previously cast away many loads, to lighten the work of our men, into the lake, and on May 24 a further large consignment of tents, trophies, spare saddles, and many other things no longer indispensable, were committed to the flames. On May 27 we had a dreadful march, and four men died after we had got them into camp. It would become monotonous were I to proceed to describe our daily worries and anxieties regarding the men and transport animals, so I will pass as rapidly as

possible over our horrible experiences, on which one little cares to linger. The ever-present Turkana following us incessantly greatly added to our difficulties.

On reference to my diary, I find that so early as June 2 sixteen of the Jehadia had either died or been killed; one servant had died, and another been killed; whilst two askaris had been killed, and one had died. Our original force of fifty-nine blacks all told had been reduced to thirty-eight already.

Travelling along the Turkwell was always an unpleasant and anxious business, as the thick forest growth and dense vegetation bordering the banks made progress along the river almost impossible. We were compelled, therefore, every day, either to proceed up the bed, now containing a running stream about knee-deep, which was a very laborious undertaking; or, on leaving camp, to strike away from the river through a thick belt of thorn and dwarf palm to the higher ground, which was more open, but thickly covered with wait-a-bit thorn. Proceeding along the higher ground in a southerly direction, about 11 a.m. we used to turn off in a south-westerly one, with a view to reaching the river-bank again to camp. This was always the most anxious part of the day's march, as one never knew what dense growth we might have to encounter, or when we were likely to reach the bank of the stream, which takes a most erratic northerly course to about 3° 6′ N. before swinging east towards Lake Rudolf. With a professional guide, in 1898 we had on several occasions spent two or three hours finding the river again towards the end of a day's march, being frequently badly hung up by the thick nature of the country, which prevented our forcing a way through.

On the whole, during our present journey south along the river, we met with extraordinary good fortune in our endeavours to get down to the water, and were not often badly involved. Our progress, however, was funereal in the extreme, owing to the debilitated state of the men (some ten or a dozen of whom were being daily carried on donkeys), which left very few partially sound men to drive the animals and look after them in this much-enclosed country. Day after day we crawled along, and on June 11 reached the outskirts of the Ngaboto district—the most southerly one of the Turkana—which was densely populated by natives. Dura was growing in quantities along the river-bank, but was all green and unfit for food, so we could obtain no grain, much to our disappointment, as we had hoped against hope to be able to purchase a little here. On June 13 we crossed the river Weiwei, which flows from the south into the Turkwell, and began to breathe again, as we trusted that we had seen the last of the Turkana, their country terminating hereabouts. They treated us to a parting shot though, by spearing the best of our remaining Jehadia that day just before dark. He foolishly crossed the river unarmed to look for

a missing donkey, when presently we heard the most blood-curdling yells, and, rushing to the river-crossing, found him lying dead mid-stream with four spear-thrusts through him. The Turkana had disappeared, of course, like magic through the thick vegetation.

We halted to rest the expedition next day. Our numbers were now reduced to thirty-two, out of the total of sixty-two (including our three selves), whilst our transport animals consisted of five mules and seventy-six donkeys. As soon as the camels had all died and been eaten, we had at once commenced eating donkey-flesh towards the end of May. Until we reached the Baringo post at the beginning of August, this was the sole meat supply we all enjoyed.

We now struck away from the Weiwei river in a south-westerly direction towards the foot of the Suk hills, which are a northerly continuation of the Elgeyo range. Our first march from the Weiwei was the most disastrous one of the whole journey, no less than six men collapsing in spite of the previous day's halt. Several of these, we were aware the previous evening, would not last out the march, in spite of being held on to donkeys; but we never contemplated quite such a collapse. We camped on the bank of a fine running stream that day, and I may here incidentally mention that I shot two vultures that were rather annoying. To my utter astonishment, there was a rush for these loathsome carrion, which were quickly plucked and boiled and subsequently devoured! We still continued in a southerly direction along the foot of these mountains, and experienced difficulties again regarding water until we reached the most northern Suk settlement of Sekere on June 17.

Here for the first time I noticed an extraordinary, to me, number of purple spots all over my legs, which I showed to Dr. Garner. A few days later, hæmorrhage of my mucous membranes set in, and I became in course of time so seriously ill with scurvy that I almost succumbed to this disease.

On June 20 we reached Marich, so familiar to Major Bright and myself, as we had previously visited this place in 1897, and again in 1898. Throughout the dreadful journey south we had always tried to buoy up the hopes of the men and ourselves by saying that once we reached Marich we would be safe, as food would be obtainable in abundance. There was none obtainable. The former smiling fields of grain we remembered so well had all disappeared, and their place was taken by long coarse grass and rank vegetation. The natives were no longer the prosperous ones they were. They were quite friendly, however, and we obtained the services of a Suk youth, who had a smattering of Ki-Swahili, and informed us that he knew the site of the Ribo post, to which he would conduct us in return for a present of two goats; to this we readily assented. I should like to meet that guileless youth again, as, after conducting us for several days to a point a few miles

south of the Kivas district, and landing us in a most atrocious bit of country, he quietly gave us the slip whilst tending our goats and sheep midst long grass after we had camped. His absence was not discovered until evening, when all the animals were brought in as usual to camp; then it was found that not only was he missing, but seven goats also, including all our milch ones! Needless to say, we never saw him again; but I live in hopes that we may meet again some day, when I may have a few points to discuss with that cherub boy.

On the Suk youth departing, we found ourselves involved in a most difficult tract of country along the lower slopes of the mountains, much broken by small ravines and mountain torrents, the banks of which were clothed in tall rank vegetation. We proceeded with much labour, as I could find no tracks through this dense growth until eventually we reached a well-populated district, known, I believe, as Chemtubell or Ndao. This place was reached in a state bordering on collapse. Our numbers had been reduced to seventeen blacks, most of whom were utterly exhausted, as were also the transport animals after our last few days' experiences, whilst my condition also was causing a certain amount of anxiety. All we now had left for the men was some 15 to 20 lbs. of grain we had a few days previously purchased from the Suk at Kivas.

In spite of our unpleasant position, we were obliged to have a rest, and, as we were camped midst cultivation, we proceeded to try and get the natives to bring in grain for sale. Our efforts met with little success for the first two days; but our luck changed with the advent of the month of July. We still had some five sheep left, which we had reserved for such a contingency, and as the natives would not look at beads, we slaughtered our sheep and exchanged meat for heads of nearly ripe grain.

Who these natives were we could never ascertain. Their hamlets, like those of the Suk, were built high up on the hillsides, and their fields were irrigated in a similar manner to those of their northerly neighbours. They are possibly an offshoot of the Wa Elgeyo, and utilized bows and arrows in preference to spears.

It was not until July 10 that we made a fresh move forward, and on that day we marched some 5 to 6 miles in an easterly direction to the river Kerio, which was crossed with considerable difficulty. Thence we continued in a south-easterly direction across the Suk plains with the object of hitting off a pass in the hills, where the plains terminate to the south. It was most necessary to find this point, as the success of our journey south towards Lake Baringo depended almost entirely on our finding it, and water in the valley of the Karuan beyond. We were delayed some days in crossing this plain, owing to relapse from nasal hæmorrhages from which I suffered, and only proceeded slowly in consequence. In spite of this, two more askaris and my servant—

Hanna, the last of our personal attendants—collapsed, and when, on July 20, we reached one of our old 1897 camps at Kisite, only fourteen blacks now remained with the column. Here for a week I was at death's door, suffering from the most severe relapse I had yet experienced.

We were delayed, therefore, until July 29, before I could continue the painful journey, riding now a donkey until we reached safety. During this long detention, large flocks and herds were brought daily by the Suk to be watered at the pools near which we were camped—at the mouth of a gorge, issuing from the hills. Among the Suk who visited us was a youth who had a fairly fluent knowledge of Ki-Swahili, and from him we heard of the existence of a post at the south end of Lake Baringo, occupied by Europeans. We placed little reliance on his assertions, as we had quite made up our minds that we should have to struggle through somehow to the Ravine station, but at the same time were glad to obtain his services as guide. On starting off again, we were accompanied by him for three marches to the north-west corner of Lake Baringo. From this point he wished to take us round the east of the lake to the post, in the existence of which he persisted.

We were sceptical, so decided to proceed by the more direct route to Njemps, along the western shore of the lake. The guide asked permission to return to his father's home by the eastern route, and readily agreed to take a note, with which Major Bright supplied him, to the Baringo post. We commenced our journey along the western shores of Baringo on August 1, camped that night on the lake-shore, and continued in a southerly direction again next day. I had hoped we might find water in the river Ndo, which flows from the Kamasia range of mountains to the west into the lake. We reached the bed of this stream, amidst thick bush, some miles from the lake-shores, but found it absolutely waterless. It was now about ten, so we decided to make a short halt before proceeding in an easterly direction towards the margin of the lake. We had thought little more of the note that had been despatched; but whilst we were resting under trees, some of the men in rear reported that a white man was riding after us on a pony, accompanied by askaris, carrying small bags of flour on their heads.

The news appeared too good to be true after all the disappointments we had met with; but presently the white man was in our midst, and proved to be Mr. Hyde-Baker, the collector of the Baringo district, who conducted us to his post some 10 miles distant. A fatted ox was slaughtered for our men that night, and the poor survivors enjoyed such a meal as they had not tasted for many a weary day past. It would never be necessary now again to kill a wretched donkey for food, as Mr. Hyde-Baker could supply rations of a more congenial nature.

The extraordinary energy and dogged perseverance of Mr. Hyde-Baker had rescued us from a most desperate position. He had received the note from the Suk youth the previous day, in which our straits were clearly described, and had started an hour and a half later with a small party of men to look for us. Continuing all that day until dark, he wandered along the western shores of the lake to the north end, where he found one of our old camps. Knowing that he must have missed us, he retraced his footsteps next day, came across our tracks, and literally hunted us down until he came up with us. The debt of gratitude that we all owe to him in succouring us will not readily be forgotten.

For the next twelve days we passed a peaceful existence on the summit of an isolated hill overlooking the lake, where Mr. Hyde-Baker had established his post. The luxury of obtaining milk, eggs, and bread again was highly appreciated, and we enjoyed much hospitality besides from our host. Mr. Hyde-Baker kindly arranged to fit out a complete caravan of his own with fresh animals under charge of some twenty to thirty of his own men, in order to convey us and our stores to the railway at Lake Nakuru.

We all left Baringo post on August 14, and in due course reached the railway at Lake Nakuro on the 21st, some 75 miles distant. On August 24 we commenced our railway journey, and on the morning of the 26th reached Mombasa, covering the 450 miles in two days, which in former times used to occupy as many months marching.

We sailed from Mombasa on September 8, and on the afternoon of the 16th reached Aden. Here we remained until September 22, when we sailed again for Suez in the Austrian-Lloyd boat *Silesia*, reaching our destination on the night of September 27. The following day we journeyed by train to Cairo, where Sir Rennell Rodd and a large number of officers had most kindly come to the station to welcome back those who had passed safely through such dreadful experiences.

Two days later I accompanied the survivors of the 10th Sudanese to Assuan, where the men met with a most cordial and stirring reception, not only from their commandant and officers, but from the whole battalion, who were awaiting the arrival of the train at the station. The regimental band played them back to the lines they had left some ten months before, and the shrill lu-luing of the women intensified the emotion of those splendid fellows. Such a reception must indeed have gone far to obliterate, temporarily only perhaps, the memory of that hideous time, when they had suffered so much, and yet which they had faced with such fortitude and determination, and a firm resolve to get through at all costs. I owe those men much. Had it not been for their loyal and exemplary behaviour, and the grand way in which they worked, none of us would ever have been heard of again —alive. Having arranged with Hunter Bey all details regarding pay

etc., of the men, and bringing to his notice the names of those especially deserving of recognition, it was my sad duty to wish them all a long good-bye and return to Cairo on October 3. A week later, Major Bright, Dr. Garner, and I were on the high seas bound for England, where we arrived on October 15, 1901.

Before the reading of the paper, the PRESIDENT said: Many here present will no doubt remember the papers that were read three years ago by Colonel Macdonald and Major Austin giving a most interesting account of their very successful work, and especially of Major Austin's work along the western side of Lake Rudolf. Since that time Major Austin has been very actively employed, and he has now made a most remarkable journey, during which there were very great hardships and sufferings to be endured, from the Nile to Mombasa. I will now ask Major Austin to read his paper.

After the reading of the paper, the following discussion took place:—

Major BRIGHT: Major Austin having given you a graphic description of our journey of some 2400 miles through British territory, from Omdurman to Mombasa, I will confine myself to saying a few words on the geographical features of the country through which we passed, from the swampy regions of the Nile to the magnificent highlands of British East Africa. They are of absorbing interest. The great Abyssinian plateau, which, roughly speaking, lies north and south, bounds a large plain extending several hundreds of miles to the Nile. In this plain there are small ranges of mountains rising abruptly from the surrounding country. The natives inhabiting this region are suspicious and very shy, which is not to be wondered at, as they are constantly harried and raided by the Abyssinians. While passing through the Musha district we frequently saw the tracks of flocks and herds, and sometimes came across a few sheep and goats, but never met with a human being. We spent some time in the neighbourhood of the Omo, which is by far the finest river in this part of Africa, and the sole perpetual feeder of Lake Rudolf. Its banks are clothed with fine trees, and some parts are extensively cultivated by the natives. This is a valuable piece of country, not only for its fertility and timber, but for its supply of fresh water, that of Lake Rudolf being far from good.

As the remainder of our journey had been previously sketched by Major Austin, he here closed his survey with the most satisfactory results on his position of 1898. Observations had been taken by him nearly every night with a 5″ theodolite for latitude and time, and as we had carried with us chronometer watches, the positions of our camps were generally fixed in this way. He had mapped our route with thousands of bearings with a prismatic compass, and used pedometres with satisfactory results. The methods of azimuths and latitudes were frequently used, the former being taken from points he had fixed. The map was plotted at 4 miles to 1 inch. The heights of mountains were determined by theodolite observations from data supplied by aneroids, and thus the map you have now before you was compiled. The country on the north-west of Lake Rudolf is an open plain with a few stunted trees. The beach is composed of black sand—this is evidently the reason why it is called by the Swahilis the "Black lake"—whereas Lake Stephanie, whose shores, I have been told, are of white sand, is termed by them the "White lake." Before reaching the Turkwell river, the country becomes a dreary desert, and there are steep cliffs rising from the beach. The Turkwell has its source in the extinct crater of Mount Elgon, and is joined by the river Wei Wei, but their united waters never reach the lake, being gradually absorbed by the porous soil. Following this river

down, its bed becomes wider and wider, until all traces of it disappear. On the west are the Chemorongi mountains (a range we had crossed in 1898); they are a continuation of the Suk hills. The slopes of these last-named mountains are well watered by small streams, forming in places beautiful cascades. This country is finely timbered and cultivated, the fields being cleverly irrigated with ingeniously contrived water-channels. The valley of the Kerio river divides the Suk mountains from the Kamasia and Ribo ranges.

From here we passed through a hilly country covered with thorn bush, being fortunate enough to find the same waterholes we had used nearly four years previously. A short but steep ascent took us on to the plateau, which slopes gently down to Lake Baringo. The view from this plateau is glorious, and the air exhilarating. In all directions are ranges of mountains. At Lake Baringo we were met by Mr. Hyde Baker, who showed us the greatest kindness. Here our journey was practically at an end. We had marched over 1100 miles, and were within 80 of the Uganda railway. Too much cannot be said in praise of this wonderful piece of engineering, and of the officials who, having surmounted incredible difficulties, have completed the line to the Victoria Nyanza. If this line at some future time is extended to join the Sudan railway, the country we traversed, with the exception of the latter portion—which could be easily avoided—would present no engineering difficulties.

I cannot conclude without a tribute of esteem and affection to Mr. Garner. A better or more unselfish companion it would be hard to find, and although far from well during the last few weeks of our journey, he never spared himself in his efforts to mitigate the sufferings of the sick, and to do even more than his share of work. Our escort from the 10th Sudanese, under a native officer, Mabruk Effendi, behaved throughout the journey in a manner beyond all praise; while the transport men, suffering more than their disciplined comrades, did as well as could be expected under such trying circumstances.

Colonel WATSON: It is with some diffidence that I rise to make a few remarks, because the part of the Sudan with which I am personally acquainted lies considerably to the west of the country through which Major Austin has just made his successful journey; but I know sufficient of those places to realize, perhaps better than many who are in this room, the skill and knowledge which were necessary to enable him and Major Bright to bring so difficult a journey to so successful a conclusion. The Geographical Society owes to both these officers, and also to Dr. Garner, who so ably supported them, and perhaps without whose assistance neither Major Austin nor Major Bright would be in the room to-day, the greatest thanks for the work which they have accomplished. There is one point to which some people in the room might like attention directed. Certain people believe in the future of a Cape to Cairo railway. I have not much confidence in the idea myself, but at the same time it is interesting to know that a very considerable part of this railway will have to pass through the very difficult country which Major Austin has spoken of. My own belief is that a Cape to Cairo railway is rather a chimerical idea, and every paper I hear on the subject tends to confirm me in that view. My feeling is that any money that can be devoted to railways in Africa should rather be devoted to lines such as the admirable line which has recently been opened from Mombasa to the Victoria Nyanza. England is a maritime nation, and what we have to do is to make railway lines inland from ports on the sea-coast, and thus open up the interior—such, for instance, as the line which is now spoken of from the Red Sea to the Nile, and which ought to have been made over twenty years ago. There is one point I would like to ask Major Austin a question upon. When I was working up the Nile and surveying the river

to the north of Gondokoro, there was in this part of the country a branch river which ran in a north-easterly direction, and a very intelligent Arab who was with me expressed the opinion, which he said he had learnt from a native, that that river continued to run north-east and joined the Sobat. If so, it must have run into the Pibor, of which we heard to-night, and I should like to ask Major Austin if such a branch could run or not. I cannot help expressing the hope that on some future occasion Major Austin may go back, and instead of turning to the south-east he should just go south-west, and give us a little information of the watershed between, we will say, 7° N. and the Sobat station. There is one other point I would like information upon. Major Austin, when he was showing his views, spoke about the station at Taufikia having been founded by the late General Gordon. Well, I was up the Nile with General Gordon, and at that time we had the Sobat station in the same place as it is at present. The station of which Major Austin told us something was established by Sir Samuel Baker—a name the Geographical Society should never forget. That station was established by Sir Samuel Baker under very difficult circumstances, the river Nile being completely blocked, and he had to wait for a year; but he established the station in what he believed to be the healthiest place, and it is to me a matter of great interest to know that more than thirty years afterwards he should have been proved to be right. I will say no more except to tender my personal thanks to Major Austin for his excellent paper and to Major Bright for the assistance he has given.

Major AUSTIN : In reply to Colonel Watson's inquiries regarding the river which branches off from the Nile at Gondokoro, I think it is more than probable that it is the Pibor river in its upper waters. Very little is known of the Pibor at present, the furthest point navigated being about 7° 30′ N. Some years ago Colonel Capper proceeded up in one of the Egyptian gunboats, and he got to about 7° 30′ N., and there found that the Pibor river rose in a large area of swamp. Now, that swamp has to be filled from some other water-supply, and I think it is more than possible that the branch you describe as striking north-east is a loop, and it is quite likely that the Nile and the Sobat are connected by this loop. These loops are very common features about all that region. Two years ago Major Bright and I came across numbers of them, which, for no apparent reason, seem to leave the parent stream, and then rejoin it some distance lower down. It is quite possible, therefore, that the Nile and the Sobat are connected by the branch Colonel Watson mentions.

The PRESIDENT : I am sure we have all listened with very great interest to the account of this very remarkable journey, and what will have struck us all, I think, is, that during the severe hardships and the anxieties from the attacks of natives, and the terrible sufferings during the latter part of the journey, these officers, and especially Major Austin, should have continued to take observations regularly and with accuracy, so that he has been able to construct a valuable map of a region a portion of which is quite new. For this I think he deserves our admiration, and I am sure the meeting will wish to pass unanimously a vote of thanks to Major Austin for his paper, and also to his companion for the observations he made afterwards.

DEEP-SEA DEPOSITS AND THEIR DISTRIBUTION IN THE PACIFIC OCEAN.*

WITH NOTES ON THE SAMPLES COLLECTED BY S.S. "BRITANNIA," 1901.

By Sir JOHN MURRAY, K.C.B., LL.D., F.R.S., etc.

THE foundations of our knowledge of the distribution and composition of deep-sea deposits in general may be said to have been laid by the *Challenger* Expedition, and the '*Challenger* Report on Deep-Sea Deposits,' by Sir John Murray and Prof. Renard, brings together all that was known on the subject up to the date of publication (1891). Since that time our knowledge has been greatly extended. Especially is this the case in the Pacific Ocean, where numerous soundings have been taken in connection with the Pacific cable and other Admiralty surveys, while valuable contributions have been made by the cruises of Dr. Alexander Agassiz in the United States Fish Commission steamer *Albatross*. The latest addition to our knowledge of the deposits covering the floor of the Pacific Ocean is derived from a study of the samples brought home by s.s. *Britannia*, collected by Mr. R. E. Peake, M.Inst.C.E., May to August, 1901, which forms the special subject of this paper.

Before proceeding to the description of this excellent series of samples, it seems desirable, briefly, to indicate the principal points relating to the classification, composition, and distribution of marine deposits. These have been divided into—

A.—LITTORAL DEPOSITS, found between tide-marks, and made up of boulders, gravels, sands, or muds, the composition of which is largely determined by the nature of the immediately adjacent land.

B.—SHALLOW-WATER DEPOSITS, found between low-water mark and the 100-fathoms line, made up of gravels, sands, muds, of varied composition, in some places the inorganic fragments from emerged land predominating, at other times the remains of benthonic organisms —that is, organisms living attached to, or crawling over, the sea-floor.

C.—DEEP-SEA DEPOSITS found beyond the 100-fathoms line, made up of muds, organic oozes, and clays, in which the remains of pelagic, or planktonic, organisms predominate—that is, those organisms living everywhere on or near the surface of the ocean.

The littoral and shallow-water deposits need not be further noticed here, since they are familiar and accessible. Our remarks will therefore be limited to the deep-sea deposits found in all the greater depths of the ocean outside the 100-fathoms line.

One of the principal factors in the determination of the composition of deep-sea deposits is the greater or less proximity to land. Near land the materials washed into the sea by rains and rivers, or torn from the

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* Map, p. 788.

coasts by waves and currents, make up a very large proportion of the deposits. The amount of these decreases as one proceeds farther and farther seaward, and the mineral particles become smaller, until, at a distance of about 200 or 300 miles from land, the land-*débris* forms but a small proportion of the deposits,* which are there composed of materials chiefly derived from the surface waters of the open ocean, such as the shells of calcareous and siliceous organisms, and the triturated particles of floating pumice. This fact furnishes us with a means of dividing deep-sea deposits into two great classes, viz.—

1. **Terrigenous Deposits**, in which the detritus from the emerged land plays the principal part; and

2. **Pelagic Deposits**, in which the detritus derived directly from the emerged land plays only a subordinate *rôle*.

1. **The Terrigenous Deposits** comprise muds and sands, varying greatly in colour and composition, and have been subdivided into blue muds, red muds, green muds, volcanic muds, and coral muds.

(*a*) Blue Mud.—This deposit is the one most frequently met with in the deeper waters surrounding continental land and in enclosed and partially enclosed seas. It is principally composed of materials derived from the disintegration of continental land, consisting largely of the fragments and minerals of continental rocks (the older crystalline and schisto-crystalline rocks, quartzites, sandstones, limestones) of various dimensions, but usually larger near shore and smaller as the deep sea is approached, except in those regions affected by floating ice. Quartz is the characteristic mineral species, associated with orthoclase and plagioclase felspars, green hornblende, mica, etc.; glauconite is usually present, but not in such abundance as in the green mud. There is usually a considerable proportion of amorphous clayey matter, increasing in amount with increasing distance from land, so that some of the deeper samples have a decidedly clayey aspect, but the deposit as a rule may be described as earthy rather than clayey. In some situations the remains of bottom-living organisms may be present in considerable numbers, and in others the remains of pelagic organisms may be so abundant that the deposit resembles a globigerina ooze.

(*b*) Red Mud.—This is a local variety of blue mud, hitherto known only from the Yellow sea in the Pacific, and off the Brazilian coast in the Atlantic, characterized by the presence of a large quantity of reddish ferruginous matter brought down by the large rivers in the vicinity.

(*c*) Green Mud.—This is a variety of blue mud, found along bold exposed coasts where no large rivers enter the sea, and distinguished by the greater or less abundance of green glauconite grains and glauconitic

* This general statement does not hold good, however, for those regions of the ocean which are seasonally or occasionally affected by icebergs and other forms of floating ice.

casts of calcareous organisms, usually associated with a greenish amorphous (probably organic) matter. In the shallower depths, the glauconitic grains and casts are sometimes associated with phosphatic concretions, while the amorphous clayey matter is less abundant, and the deposits, being more granular and more incoherent, are called GREEN SANDS.

(*d*) VOLCANIC MUDS.—This deposit occurs around oceanic islands and submarine elevations of volcanic origin, and is made up largely of volcanic rock-fragments and volcanic mineral particles, such as lapilli of basaltic and andesitic rocks, especially the vitreous varieties, sanadine, plagioclase, augite, hornblende, rhombic pyroxenes, olivine and magnetite. In the shallower waters the volcanic particles are larger, associated with less amorphous clayey matter, and the deposits, being less coherent, are called VOLCANIC SANDS. The remains of planktonic or benthonic calcareous organisms may become so abundant that it is sometimes difficult to distinguish this deposit from a globigerina ooze on the one hand, or from a coral mud or sand on the other.

(*e*) CORAL MUD.—This deposit occurs off coral islands and coral reefs, and is chiefly made up of the fragments of organisms living in the shallow waters and on the reefs, such as calcareous algæ, corals, molluscs, polyzoa, annelids, echinoderms and foraminifera. In the shallower waters near the reefs, these calcareous fragments are larger and the more finely divided calcareous matter less abundant than in the deeper waters further removed from the reefs, and the deposits are called CORAL SANDS. These deposits may contain, at times, much volcanic material.

2. **The Pelagic Deposits** are classified according to their characteristic constituents, and have been subdivided into globigerina ooze, pteropod ooze, diatom ooze, radiolarian ooze, and red clay.

(*a*) GLOBIGERINA OOZE.—This deposit is named from the predominance of the dead shells of foraminifera, which lived in the surface waters of the ocean, the genus *Globigerina* being the most characteristic, though the representatives of other genera are usually present in the tropics. Associated with the shells of pelagic foraminifera are the shells of pelagic molluscs (pteropods and heteropods), pelagic calcareous algæ (coccospheres and rhabdospheres, or their broken fragments—coccoliths and rhabdoliths), as well as the remains of calcareous organisms which habitually live on the bottom of the sea, such as molluscs, echinoderms, annelids, corals, polyzoa and bottom-living foraminifera. The remains of siliceous organisms (radiolaria, diatoms, and sponge spicules) may generally be detected, and a few small mineral particles, such as felspar, augite, hornblende, magnetite and volcanic glass, with a small quantity of clayey matter coloured by the oxides of iron and manganese. This deposit varies greatly in composition both with respect to the species of organisms present and their relative abundance, and also in the

abundance and nature of the mineral constituents. In all the great depths of the ocean, exceeding 2500 or 3000 fathoms, globigerina ooze gives place to red clay, even in those regions where pelagic foraminifera inhabit the surface waters in great profusion; this is ascribed to the longer time during which the shells are exposed to the solvent action of sea-water, while falling through the greater depth of water and while lying uncovered on the bottom.

(*b*) Pteropod Ooze.—This deposit differs from globigerina ooze only in the greater abundance of the shells of pelagic molluscs (pteropods and heteropods), and occurs characteristically at lesser depths than the globigerina ooze. Thus pteropod ooze may be said to attain its typical development at depths of 800 to 1000 fathoms, while globigerina ooze occurs typically at depths of 1500 to 2000 fathoms. The reason why the shells of pelagic molluscs are removed from the deposits sooner than the shells of pelagic foraminifera, is believed to be the larger surface which these thin and fragile shells present to the solvent action of sea-water.

(*c*) Diatom Ooze.—This deposit is distinguished by the prominence of diatom frustules, and is therefore characteristic of those regions in which these pelagic algæ swarm in the surface waters, as in the extreme northern part of the Pacific and in the far south in the neighbourhood of the Antarctic circle. The skeletons of radiolaria and the shells of one or two species of pelagic foraminifera are usually present, as well as continental mineral particles and ice-borne rock fragments, since this deposit occurs generally within the regions affected by floating ice.

(*d*) Radiolarian Ooze.—This deposit is distinguished by the abundance of the skeletons of radiolaria, and is found typically in very deep water in the tropical regions of the Pacific and Indian oceans. It is otherwise similar to the red clay next to be described, and may contain a few shells of pelagic foraminifera and small angular volcanic mineral particles, fragments of pumice, augite, felspars, hornblende, magnetite, volcanic glass frequently altered into palagonite, as well as manganese nodules, sharks' teeth, and ear-bones of cetaceans.

(*e*) Red Clay.—This deposit is the most characteristic, and probably the most widely distributed, of all deep-sea deposits over the ocean's floor, covering a very large portion of the deeper part of the Pacific. The name is sufficiently expressive of the nature and appearance of this type of deposit, there being always a considerable proportion of amorphous clayey matter, usually of a reddish colour, passing in some regions into a dark chocolate colour from the abundance of small grains of peroxide of manganese.* Usually the red clay contains very few, if any, remains of calcareous organisms, but occasionally there may be an appreciable admixture of the shells of pelagic and bottom-living foraminifera, teeth

* Whenever manganese is mentioned in these notes, the peroxide of manganese is meant.

and otoliths of fishes, fragments of echinoderms, molluscs, ostracodes, polyzoa, etc., and on approaching shallower water in tropical and temperate regions, the shells of pelagic foraminifera become more and more numerous until the red clay passes into globigerina ooze. The remains of siliceous organisms (radiolaria, diatoms, sponge spicules, arenaceous foraminifera) may generally be detected, and in some regions where the radiolarian remains become abundant, the red clay passes gradually into radiolarian ooze, while in other regions towards the far north and far south the diatom remains increase in number, and the red clay may pass insensibly into diatom ooze. Among the inorganic elements met with in red clay, the most constant and widely distributed is pumice, which occurs in larger and smaller fragments down to the most minute particles, and in all stages of disintegration and decomposition; the minerals found in pumice, like sanadine, plagioclase, augite, hornblende, magnetite, etc., are also present, along with basic volcanic glasses frequently transformed into palagonite. The peroxides of iron and manganese are universally distributed throughout the red clays, sometimes as minute grains or coatings, sometimes deposited as concretions around organic remains, pumice fragments and other nuclei, forming manganese nodules of larger or smaller size, especially where the *débris*, ashes and lapilli, of basic volcanic rocks are abundantl and have undergone decomposition. These manganese nodules vary in form and size in different localities: at one place they may be large, subspherical and smooth, resembling a lot of potatoes; at another place smaller, like marbles; at another place large and spherical, but the external surfaces rough to the touch owing to the numerous mammillations; at another place flattened with one side rougher than the other, and at yet another place the nodules take the form of huge slabs. With the manganese nodules are usually associated, especially in deep water far from land, numerous teeth of sharks and ear-bones of whales, impregnated and coated more or less thickly by the peroxides of iron and manganese. In the red clays, also, numerous minute magnetic spherules, some with metallic nuclei, have been met with, and have also been extracted from the manganese nodules after these have been broken up in a mortar; these spherules are supposed to have fallen from interstellular space, and are hence called cosmic spherules. In some positions, again, there are small zeolitic crystals (phillipsite) in individuals, twins, stellate groups and spherulitic aggregations, which are supposed to be secondary products, formed *in situ*, arising from the decomposition of the basic volcanic particles present in the deposits.

All the varieties of deep-sea deposits pass, gradually, the one into the other, there being no sharp line of demarcation between them. Very frequently it is difficult to say whether a sample should be called a blue mud, a globigerina ooze, or a red clay, although typical samples of these are well marked and distinct.

Having thus briefly indicated the chief characteristics of the different types of deep-sea deposits, we may, in a few words, allude to their distribution over the floor of the Pacific ocean, as laid down approximately on an equal surface-projection hemisphere in accordance with the present state of our knowledge.

The Pacific ocean is usually looked upon as being bounded to the south by the parallel of 40° S. lat.; the great circumpolar Southern ocean lies between the parallels of 40° S. and the Antarctic circle, the Antarctic ocean being looked upon as circumscribed by the Antarctic circle. In the first instance, we will take the Pacific ocean in its limited sense—that is, as bounded on the north by the Aleutian islands; on the west by the Kurile islands, Japan, Formosa, Philippines, Gilolo, New Guinea, and the east coast of Australia; on the east by the coasts of North and South America; and on the south by the parallel of 40° S. As thus defined, the area is estimated at about 38,000,000 square geographical miles, and of this area we estimate that the red clay covers approximately about 67 per cent., the globigerina ooze about 13 per cent., the radiolarian ooze about 10 per cent., the terrigenous deposits (excluding coral mud) about 5 per cent., the diatom ooze about 2 per cent., the coral mud about 2 per cent., and the pteropod ooze about 1 per cent.

The area of the Southern ocean lying to the south of the Pacific, from the longitude of Tasmania on the west, to the South American coast and the meridian of 70° W. on the east, is estimated at about 7,750,000 square geographical miles; of this area we estimate that the globigerina ooze covers about 47 per cent., the diatom ooze about 24 per cent., the red clay about 23 per cent., and the terrigenous deposits (blue mud, etc.) 6 per cent.

The area of the Antarctic ocean lying to the south of the Pacific is estimated at about 1,300,000 square geographical miles, and this area, as far as our knowledge extends at the present time, is entirely covered by blue mud.

Taking the basin of the Pacific in its total extent (excluding, of course, the partially enclosed seas fringing its northern and western margin)—that is, from the Aleutian islands on the north to the Antarctic continent on the south, the area is estimated at about 47,000,000 square geographical miles; of this area we estimate that about 58 per cent. is covered by red clay, about 18 per cent. by globigerina ooze, about 8 per cent. by radiolarian ooze, about 8 per cent. by terrigenous deposits (excluding the coral mud), about 5 per cent. by diatom ooze, about 2 per cent. by coral mud, and about 1 per cent. by pteropod ooze.

We may now indicate the distribution of the various types of deep-sea deposits over the basin of the Pacific, treating them in the order of their importance.

(*a*) Red Clay.—This deposit attains its most typical development

in the deep-water regions of the Pacific, covering more than one-half of the total area. It was from the central regions of the Pacific that the *Challenger* brought up the largest hauls of manganese nodules, associated with many sharks' teeth and ear-bones of whales. In the Northern Pacific it stretches from off the coast of North America to off the coasts of Japan and the Philippines, extending to the north of lat. 50° N. Separated from this area by radiolarian ooze and globigerina ooze is an area in the South Pacific which stretches across from the South American coast to the great volcanic rift lying to the east of the Samoan, Friendly, and Kermadec groups, in which depths exceeding 5000 fathoms have been obtained, extending to the south of lat. 50° S. Since the radiolarian ooze is merely a variety of red clay, it may be said that red clay (using the term to include radiolarian ooze) stretches in the Pacific from north to south through over 100° of latitude. An isolated area lies between the Fijis, Kermadecs, Norfolk island, and New Caledonia. Another isolated area lies off the east coast of Australia, and another in the deep water to the west of the New Hebrides, extending into the Coral sea.

(*b*) Globigerina Ooze.—Next in importance to the red clay is the globigerina ooze, which covers an extensive area stretching from the Coral sea and the sea surrounding the Fijis southwards to New Zealand, passing to the west and south of New Zealand uninterruptedly across the Southern ocean towards the coast of South America. There is an extensive area in the equatorial regions of the Central Pacific, surrounding Palmyra and Fanning islands, extending from long. 135° to 167° W. Globigerina ooze occurs also around all the groups of coral and volcanic islands, and on the summits or flanks of submarine elevations where the bottom rises from very deep water to depths less than 2000 fathoms.

(*c*) Radiolarian Ooze.—This type of deposit is now known to cover an extensive area of the floor of the Pacific. It has been traced from the Gulf of Panama and the coasts of Central America, between the latitudes of 5° S. and 15° N., extending through more than 80° of longitude, as far as long. 165° W. Another extensive area occurs around the Phœnix and Union groups of islands, stretching from lat. 13° S. to 8° N., and from long. 162° W. to 178° E. A smaller area occurs a little farther east, approximately between lat. 3° and 8° S., and long. 152° and 155° W. Another area occurs farther north, approximately in lat. 36° to 39° N., and long. 163° to 178° W. Radiolarian ooze also occurs between the Caroline and Ladrone groups of islands, in the region of the deepest water known on the face of the globe. Here the *Challenger's* deepest sounding in 4475 fathoms brought up a good sample of radiolarian ooze; here Dr. Alexander Agassiz sounded in 4813 fathoms, not far from Guam island, and the material brought home indicates the presence of many siliceous organisms (diatoms and

radiolaria) in the deposit; here the U.S. steamer *Nero* sounded in 5150 and 5269 fathoms (this last being the deepest sounding hitherto recorded in the ocean), and when the material comes to be examined it will probably prove that the deposit is radiolarian ooze.

(*d*) Terrigenous Deposits (excluding Coral Mud).—No attempt has been made to estimate the area of the floor of the Pacific covered by volcanic mud and green mud, as distinguished from blue mud, though we have estimated approximately the area occupied by coral mud. Around the margins of the continents of North and South America, Asia, Australia (except in the neighbourhood of the Great Barrier reef), and the Antarctic continent, the prevailing deposit is blue mud. At certain points glauconite occurs in the deposits to such an extent that they are called green muds, as off the east coast of Australia, near Sydney, off Japan, and several places along the coast of North America. Around all the oceanic islands of volcanic origin, like the Sandwich islands, New Hebrides, etc., volcanic muds occur. They are also met with in the vicinity of submarine elevations, which are the result of recent volcanic activity; several such elevations are now known in the seas around the Fijis and along the ridge extending northwards from New Zealand by the Kermadecs and Friendly islands to the Samoan group. In this region a volcanic island, to which the name of Falcon island was given, was thrown up near the Friendly islands a few years ago, but the loose volcanic scoriæ of which it was composed were gradually spread out by the action of the waves until the island became a shoal. In this region also Mr. Peake collected a sample of loose volcanic material, different from anything hitherto known from such a depth (see description of Sounding 420, p. 709).

(*e*) Diatom Ooze.—This deposit occurs typically in the Great Southern ocean surrounding the belt of blue mud bordering the Antarctic continent, and it has also been traced in a continuous band bordering the northern margin of the Pacific from off the coast of Yezo in Japan, by way of the Kurile islands, Kamtschatkan peninsula, Aleutian islands, and Alaskan peninsula, till it approaches the coast of Vancouver island.

(*f*) Coral Mud.—This deposit, as its name indicates, is associated with the coral reef region of the Pacific; it occurs along the Great Barrier reef of Australia, and off all the coral islands and coral reefs, but it is comparatively limited in its distribution, rapidly giving place on receding from the reef to volcanic mud if in the vicinity of a volcanic island, or to pteropod ooze or globigerina ooze in the case of atolls.

(*g*) Pteropod Ooze.—This type of deposit is limited in its distribution to the shallower regions of the deep sea far from continental land, and is found characteristically on the summits of submarine elevations which rise into depths less than 1000 fathoms in the tropical parts of

the great ocean basins, and in the vicinity of coral atolls outside the zone of coral mud. In the Pacific there is a considerable area in the coral reef region of the Coral sea bordering the Great Barrier reef of Australia and on the summits of the "Britannia hills," Balfour shoal,* and other elevations in the seas between Australia, New Zealand, and the Union and Ellice groups, and around some of the coral islands of the Paumotu and Marquesas groups. It will be observed that the localities mentioned are all south of the equator, and it is rather curious that we have not hitherto recognized pteropod ooze among the collections examined by us from the North Pacific, which is doubtless due to the fact that very little material is available from the moderate depths of this region.

In the preceding paragraphs we have indicated the general characters of the different types of deep-sea deposits, and their distribution throughout the basin of the Pacific ocean, and we may now proceed to deal with the samples collected by s.s. *Britannia* in 1901, which have been submitted to us by Mr. Peake for examination.

The total number of samples received is 597. The great majority of them are amply sufficient for a complete examination, but in some instances the amount of material obtained does not suffice to indicate with precision the nature of the deposit at the bottom; in other cases the material is incoherent, and appears to us to have been submitted to a certain amount of washing while being brought up to the surface.

The following table shows the distribution in depth of the 597 samples :—

90	samples	come from	depths less than 100 fathoms.
114	"	"	between 100 and 1000 fathoms.
206	"	"	" 1000 " 2000 "
180	"	"	" 2000 " 3000 "
7	"	"	over 3000 fathoms.
597			

The deepest sample comes from 3150 fathoms.

Of the 597 samples, 76 were insufficient to enable us to determine the type of deposit, and in 24 cases the samples were obtained on the border lines between two or three different types of deposit. For instance, six of the samples might equally well have been called red clay or radiolarian ooze, other four either red clay or globigerina ooze, other six either globigerina ooze or volcanic mud, and so on. Making allowance for these doubtful and insufficient samples, there remain 497 samples which we have been able to assign to distinct types of deposits; of these, by far the great majority are globigerina oozes, since

* See Murray, *Scott. Geo. Mag.*, vol. xiii. p. 120, 1897.

the course followed by the *Britannia* lay principally through regions of moderate depth, as will be seen from the following table:—

294	samples are referred to		globigerina ooze.
65	"	"	red clay.
43	"	"	radiolarian ooze.
45	"	"	coral mud or sand.
27	"	"	pteropod ooze.
12	"	"	blue and green muds.
11	"	"	volcanic mud or sand.
497			

Before giving descriptions of a few of the *Britannia* soundings we may briefly refer to the deposits met with along the route followed by the s.s. *Britannia* during this cruise. Starting from Southport, New South Wales, the material brought up within the 100 fathoms line was mostly made up of fragments of mollusc shells, polyzoa, and other bottom-living organisms, with grains of quartz, mica, etc., but after crossing the 100 fathoms line, two samples of pteropod ooze were obtained from 385 and 530 fathoms, passing at 860 fathoms into globigerina ooze, which continued until the depth increased to over 2000 fathoms, where the deposit was red clay.

On approaching the "Britannia hills," the deposit was again globigerina ooze in depths less than 2000 fathoms, while pteropod ooze apparently covered the summits and upper portions of these elevations, the discovery of which forms one of the most important results of this expedition. It would have been extremely interesting to have had a good supply of the material covering the "Britannia hills" at various depths from the summits out into the deep sea, but unfortunately the shallower casts produced very little material, the snapper being frequently dented and empty. The material that did reach our hands consisted of—

(*a*) From 249 fathoms, a fragment of the arm of an ophiurid;

(*b*) From 450 fathoms, a few small fragments of corals and pteropods;

(*c*) From 478 fathoms, a good sample of pteropod ooze, which we have described;

(*d*) From 527 fathoms, a piece of volcanic rock coated with the peroxide of manganese;

(*e*) From 660 fathoms, a good sample of the deposit which might be called either globigerina or pteropod ooze, the pteropods and fragments being much less numerous than in 478 fathoms.

In greater depths the pteropod ooze passes into globigerina ooze, just as has been observed in the case of the "Balfour shoal" (already mentioned) lying further to the north. These observations indicate that the submarine elevations, which Mr. Peake has called the "Britannia hills," are fundamentally composed of volcanic rocks, which are now covered

ˀımerous benthonic animals, whose remains are mixed up with a ɔrable covering of deposits chiefly composed of the remains of gic or planktonic animals.

Proceeding eastwards from the "Britannia hills" the deposit is almost uninterruptedly globigerina ooze, though two samples from 2680 and 2603 fathoms approach closely in character to red clays. On approaching Norfolk island the globigerina ooze passes into pteropod ooze in depths of 300 to 700 fathoms, with coral sand in the lesser depths, the material from depths less than 100 fathoms being made up of fragments of corals and calcareous algæ, and mollusc shells. Proceeding towards New Zealand from Norfolk island, pteropod ooze is again found in depths under 900 fathoms, with globigerina ooze continuing all the way till the shallow waters surrounding New Zealand are reached. There the deposits are blue muds, while we have called two of the samples from 168 and 180 fathoms green muds, one of which will be found described in the sequel. In the shallow waters of Doubtless bay and Whangaroa bay the material is chiefly made up of broken mollusc shells with rounded pebbles.

Proceeding back to Norfolk island from New Zealand, a few soundings were taken, and then the cruise was continued from Norfolk island in a north-easterly direction towards Fiji. After crossing the zone of pteropod ooze, globigerina ooze was again encountered in depths exceeding 1000 fathoms until approaching latitude 25° S., where the globigerina ooze gradually gave place to red clay in depths over 2000 fathoms. On passing to the east of Conway reef, globigerina ooze was again met with in depths less than 2000 fathoms, the soundings over 2000 fathoms being always red clay. The depth of the boundary line between the globigerina ooze and the red clay thus varies greatly in different regions, being principally determined by the conditions at the surface. Between Conway reef and Kandavu the bottom is apparently rather irregular, the *Britannia* taking soundings in 948, 840, and 836 fathoms, separated from each other by deeper water; the deposit at the two first mentioned was globigerina ooze, while no deposit was obtained at the last mentioned, where the shot on the sounding-tube became jammed. There seemed to be indications of volcanic activity in this locality, for the samples from 1369 and 1388 fathoms contained volcanic rock fragments and minerals in some abundance, while the sample from 1491 fathoms is one of the most peculiar from so great a depth which has ever passed through our hands, consisting almost entirely of volcanic lapilli (see description, p. 709). Close to the Fijis the globigerina ooze passes in some places into pteropod ooze, in others, as on approaching Suva, into volcanic mud, with coral muds close to the reefs.

On leaving the Fijis by the Nanuku passage, the material obtained showed the presence of a good deal of manganese associated with

volcanic *débris*. The shells in the pteropod oozes from 518 and 641 fathoms were blackened by manganese; a fragment of a manganese nodule was obtained from 455 fathoms; a fragment of white calcareous tufa coated with manganese was brought up from 425 fathoms; fragments of pumice coated with manganese were obtained from 1391, 1448, 1390, 1025, 830, and 1375 fathoms.

Proceeding in a north-easterly direction towards the Samoan islands, the bottom showed some irregularities, and the soundings contained a considerable quantity of volcanic material associated with manganese; at 1390 and 1350 fathoms the deposit was globigerina ooze, containing many manganese grains; at 1269, 1190, and 1133 fathoms it was difficult to say whether the deposit should be called globigerina ooze or volcanic mud. At 900, 1150, 1126, and 1166 fathoms the deposit was volcanic mud (see description of sounding 487, p. 709). These were obtained in the vicinity of a submarine elevation covered by 400 fathoms of water, from the summit of which we received no material, but Mr. Peake says the sounding-tubes came up dented and showing a trace of manganese. Two casts of 825 and 1135 fathoms on the northern slope of this elevation procured no sample of the bottom, and the tubes came up dented, as was also the case in 1410 fathoms, a little further to the north-east.

Proceeding north-eastwards, the bottom again shoaled to 480 fathoms, the material from this cast being decomposed pumice, which had apparently formed the nucleus of a manganese nodule, and from 1510 fathoms on the eastern slope a fragment of volcanic rock coated with manganese came up jammed between the tubes, with a trace of volcanic material within the tubes. From this elevation the bottom slopes down rapidly to the north-east, being covered by red clay in depths of 2145, 2565, 2553, and 2224 fathoms. Crossing the parallel of 14° south, another elevation was met with at 1490 fathoms, the sounding-tube bringing up a fragment of a manganese nodule with nucleus of decomposed volcanic rock. The deposit at the neighbouring deep soundings was red clay, containing a good many radiolaria, which organisms increased in abundance as the passage between Savaii and the Pasco Bank was approached, and the red clay passed insensibly into radiolarian ooze. About halfway between Savaii and Pasco Bank another submarine elevation, with 1000 fathoms over it, was revealed, fragments of a pure black manganese nodule being brought up. In the deep water to the north-west the deposit was red clay or radiolarian ooze, containing many splinters of recent volcanic glass, while to the north the deposit was red clay or globigerina ooze, containing fragments of pumice impregnated with manganese. Two soundings taken to the south-east show that the slope in this direction is more gentle; we received no material from these two soundings, but Mr. Peake says that at 1433 fathoms the washer was covered by globigerina shells, and at 1590 fathoms the tubes were smeared with manganese. To the south-west,

at 2009 fathoms the tubes came up empty and dented, and at 2580 fathoms the tubes were empty, with a trace of manganese on them, while at 2553, 2568 and 2575 fathoms the deposit was radiolarian ooze. Proceeding to the north-east from this elevation, the water was found to be very deep, and the deposit at 2560 and 2549 fathoms was red clay, passing gradually at 2540 and 2528 fathoms into radiolarian ooze, which continued until, on approaching the Union group of islands, globigerina ooze was met with at depths of 2269 to 2648 fathoms. One of the samples from the border-line between these two deposits was interesting, because it showed the one type overlain by the other, the lower portion being a dark chocolate-coloured radiolarian ooze, covered by a cream-coloured globigerina ooze. In this neighbourhood manganese was met with in several of the soundings; at 2626 fathoms, Mr. Peake says, a large manganese nodule was jammed between the tubes; at 2428 fathoms the tubes were smeared with manganese, and one of them bent; at 2331 fathoms the tubes were smeared with manganese, and one of them bent; at 2548 fathoms some manganese was on the bottom of the tubes, and two of them were dented; at 2178 fathoms the sounding-tubes came up slightly dented, with trace of manganese on them, and the sounding was repeated in 2220 fathoms with snapper, which came up dented and smeared with manganese; at 2295 fathoms an elongated manganese nodule (or rather two nodules cemented together) was brought up; at 2465 fathoms the tube was kept open by a large manganese nodule; at 2808 fathoms there was a trace of manganese on the tubes; at 2875 and 2830 fathoms the tubes were smeared with manganese; at 2963 fathoms a flattish manganese nodule 4 cm. in diameter was obtained; at 2912 fathoms a small round nodule 2 cm. in diameter was brought up; at 2081 and 2290 fathoms the tubes were smeared with manganese.

On proceeding north-east from the Union group of islands the water deepened and the globigerina ooze passed again into radiolarian ooze, which occupied the sea-floor in depths of 2800 to 3150 fathoms between the equator and latitude 7° S. In the neighbourhood of the equator, although the water was still very deep, the remains of pelagic calcareous organisms became very abundant, and the deposit again changed gradually into globigerina ooze. The deposits collected, both by the *Challenger* and the *Penguin*, had already shown the presence of globigerina ooze at much greater depths under the waters of the counter equatorial current in the Pacific than in other regions of the ocean, and this is evidently due to the relatively much greater abundance of pelagic calcareous organisms in the waters of this current. The globigerina ooze continued until the zone of coral mud surrounding Fanning island was met with, and in like manner, in proceeding north-eastwards from Fanning island, globigerina ooze again covered the sea-floor until, on approaching the parallel of 8° N., the water deepened and the globigerina

ooze gave place to radiolarian ooze, fragments of manganese nodules being brought up from depths of 2425 and 2708 fathoms.

This cruise of the *Britannia* has added considerably to our knowledge regarding the depths and the distribution of the deposits in that portion of the Pacific ocean traversed by the expedition. In the first place, the discovery of the "Britannia hills," rising to within less than 300 fathoms beneath the surface, in a region where previously depths of 2500 fathoms had been observed, is a most important result. Several other submarine elevations were also revealed by the *Britannia's* soundings, especially in the seas around the Fijis, some of which have been referred to in the preceding remarks. The line of soundings run between Norfolk island and New Zealand was extremely useful in defining more accurately some of the deeper contour lines of depth, especially the 2000 fathoms line. The line of soundings between the Union group and Fanning island was also extremely useful in defining the 3000 fathoms line, which had been previously laid down in this region much farther to the east.

As regards the additions to our knowledge of the deposits, pteropod ooze must now be introduced on the summits of the "Britannia hills," and on the borders of the blue mud area off the Australian coast. The *Britannia* samples also show that a zone of pteropod ooze surrounds the coral mud area around Norfolk island. The two samples of green mud from off the north-east coast of New Zealand are also interesting, as glauconite had not previously been observed in any abundance in this locality. In the passage between Pasco bank and Savaii, radiolarian ooze was met with farther south than had been previously recorded.

Appended are detailed descriptions of a few of the more typical and interesting samples, according to the plan adopted in the '*Challenger* Report on Deep-Sea Deposits.' In the examination of these deposits, and in the preparation of these notes for publication, I have to acknowledge the continuous assistance of Mr. James Chumley and Mr. Robert Dykes.

Sounding 11.—May 18, 1901, lat. 28° 3′ 2″ S., long. 154° 1′ 59″ E., 385 fathoms.

Pteropod Ooze, brownish grey, coherent, plastic, granular; containing—

(*a*) Calcium Carbonate (64·06 per cent.), made up of pteropods and heteropods and fragments, pelagic foraminifera (including *Globigerina bulloides*, *G. sacculifera*, *G. conglobata*, *G. dubia*, *G. rubra*, *G. æquilateralis*, *Sphæroidina dehiscens*, *Orbulina universa*, *Pullenia obliquiloculata*, *Pulvinulina menardii*, *P. tumida*, *P. canariensis*, *P. micheliniana*), bottom-living foraminifera (including *Biloculina*, *Spiroloculina*, *Nodosaria*, *Uvigerina*, *Cassidulina*, *Anomalina*, *Cristellaria*), echini spines, ostracodes, otoliths of fishes, tunicate spicules, coccoliths, rhabdoliths;

(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (35·94 per cent.), grey-brown, consisting of—

(1) *Minerals* (15 per cent.), mean diameter 0·15 mm., angular, including quartz, mica (muscovite), felspar, hornblende, volcanic glass, magnetite;

(2) *Siliceous organisms* (7 per cent.), including sponge spicules, arenaceous foraminifera, clayey casts of calcareous organisms;
(3) *Fine washings* (13·94 per cent.), made up of amorphous clayey matter, together with minute particles of minerals and siliceous organisms.

Sounding 32.—May 28, 1901, lat. 28° 12′ 39″ S., long. 155° 35′ 29″ E., 478 fathoms.
Pteropod Ooze, creamy white, plastic, coherent; containing—
(*a*) Calcium Carbonate (88·76 per cent.), made up of pteropods (including *Clio subula*, *C. australis*, *Cavolinia*), heteropods (*Atlanta*), pelagic foraminifera (including *Globigerina bulloides*, *G. conglobata*, *G. æquilateralis*, *G. rubra*, *G. dubia*, *G. sacculifera*, *Candeina nitida*, *Pullenia obliquiloculata*, *Pulvinulina menardii*, *P. tumida*, *P. micheliniana*, *P. canariensis*, *Orbulina universa*, *Sphæroidina dehiscens*), bottom-living foraminifera (including *Biloculina*, *Uvigerina*, *Nodosaria*, *Amphistegina*), ostracodes, otoliths, echini spines, larval lamellibranchs and gastropods (*Pleurotoma*), coccoliths, rhabdoliths;
(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (11·24 per cent.), brown, consisting of—
(1) *Minerals* (3 per cent.), mean diameter 0·1 mm., angular, including felspar, volcanic glass, magnetite;
(2) *Siliceous organisms* (1 per cent.), only sponge spicules observed;
(3) *Fine washings* (7·24 per cent.), made up of amorphous clayey matter, with minute mineral particles and fragments of sponge spicules.

Sounding 43.—May 31, 1901, lat. 27° 51′ S., long. 155° 54′ 30″ E., 2676 fathoms.
Red Clay, mottled white and grey, plastic, coherent; containing—
(*a*) Calcium Carbonate (21·13 per cent.), made up of broken pelagic foraminifera (including *Globigerina æquilateralis*, *G. conglobata*, *Sphæroidina dehiscens*), coccoliths and rhabdoliths;
(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (78·87 per cent.), grey brown, consisting of—
(1) *Minerals* (3 per cent.), mean diameter 0·07 mm., angular, including felspar, augite, hornblende, volcanic glass;
(2) *Siliceous organisms* (2 per cent.), including radiolaria and sponge spicules;
(3) *Fine washings* (73·87 per cent.), amorphous clayey matter, with a few minute mineral particles and fragments of siliceous organisms.

Sounding 61.—June 2, 1901, lat. 28° 29′ 4″ S., long. 155° 1′ 24″ E., 2488 fathoms.
Red Clay, dark grey, unctuous; containing—
(*a*) Calcium Carbonate (17·57 per cent.), made up of fragments of pelagic and bottom foraminifera, echini spines, coccoliths (some very large);
(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (82·43 per cent.), dirty grey, consisting of—
(1) *Minerals* (5 per cent.), mean diameter 0·07 mm., angular, including augite, mica, felspar, hornblende, magnetite, and volcanic glass. Many small black spherules unaffected by hydrochloric acid and non-magnetic were observed, the nature of which is uncertain.
(2) *Siliceous organisms* (3 per cent.), including sponge spicules, radiolaria, diatoms, fragments of arenaceous foraminifera.
(3) *Fine washings* (74·43 per cent.), made up of amorphous clayey matter, together with minute mineral particles and fragments of siliceous organisms.

SOUNDING 102.—June 7, 1901, lat. 28° 53′ S., long. 160° 14′ E., 1290 fathoms.
Globigerina Ooze, rose or cream colour, granular; containing—

(*a*) CALCIUM CARBONATE (82·57 per cent.), made up of pelagic foraminifera (including *Orbulina universa*, *Globigerina conglobata*, *G. bulloides*, *G. dubia*, *G. sacculifera*, *G. rubra*, *G. æquilateralis*, *G. inflata*, *Pulvinulina micheliniana*, *P. canariensis*, *P. crassa*, *Pullenia obliquiloculata*, *Sphæroidina dehiscens*), bottom-living foraminifera, fish teeth, coccoliths, rhabdoliths;

(*b*) RESIDUE, after removal of calcium carbonate by dilute hydrochloric acid (17·43 per cent.), brown, consisting of—

(1) *Minerals* (1 per cent.), mean diameter 0·06 mm., rounded, including augite, felspar, &c.;

(2) *Siliceous organisms* (2 per cent.), including sponge spicules, arenaceous foraminifera, radiolaria.

(3) *Fine washings* (14·73 per cent.), made up of amorphous clayey matter, together with minute particles of minerals and siliceous organisms.

SOUNDING 114.—June 8, 1901, lat. 28° 49′ 15″ S., long. 162° 17′ 30″ E., 748 fathoms.
Globigerina Ooze, cream colour, soft and plastic, coherent; containing—

(*a*) CALCIUM CARBONATE (82·65 per cent.), made up of pelagic foraminifera (including *Globigerina bulloides*, *G. conglobata*, *G. æquilateralis*, *G. rubra*, *G. dubia*, *G. sacculifera*, *Orbulina universa*, *Sphæroidina dehiscens*, *Pullenia obliquiloculata*, *Pulvinulina menardii*, *P. tumida*, *P. canariensis*, *P. micheliniana*, *Hastigerina*), bottom-living foraminifera (including *Pullenia sphæroides*, *P. quinqueloba*, *Nodosaria*, *Uvigerina*, *Biloculina*, *Amphistegina*), ostracodes, otoliths of fish, echini spines, coccoliths, rhabdoliths, and coccospheres;

(*b*) RESIDUE, after removal of calcium carbonate by dilute hydrochloric acid (17·35 per cent.), brown in colour, consisting of—

(1) *Minerals* (2 per cent.), mean diameter 0·07 mm., angular, including felspar, hornblende, volcanic glass, magnetite;

(2) *Siliceous organisms* (3 per cent.), including radiolaria, arenaceous foraminifera, small sponge and sponge spicules, diatoms;

(3) *Fine washings* (12·35 per cent.), made up of amorphous clayey matter, with minute mineral particles and fragments of siliceous organisms.

SOUNDING 155.—June 14, 1901, lat. 28° 58′ 52″ S., long. 167° 40′ E., 600 fathoms.
Pteropod Ooze, greyish brown, coherent; containing—

(*a*) CALCIUM CARBONATE (87·12 per cent.), made up of pteropods (including *Clio subula*, *C. australis*), heteropods (*Atlanta*, *Carinaria*), pelagic foraminifera (including *Globigerina bulloides*, *G. conglobata*, *G. æquilateralis*, *G. sacculifera*, *G. rubra*, *Sphæroidina dehiscens*, *Pullenia obliquiloculata*, *Orbulina universa*, *Pulvinulina canariensis*, *P. crassa*, *P. micheliniana*), bottom-living foraminifera (including *Nodosaria*, *Cristellaria*, *Pullenia bulloides*, *Uvigerina*, *Biloculina*, *Cassidulina*), alcyonarian spicules, tunicate spicules, echini spines, otoliths of fishes, ostracodes, larval molluscs, polyzoa, coccoliths, rhabdoliths, coccospheres;

(*b*) RESIDUE, after removal of calcium carbonate by dilute hydrochloric acid (12·88 per cent.), brown, consisting of—

(1) *Minerals* (2 per cent.), mean diameter 0·1 mm., angular, including felspar, augite, hornblende, muscovite, volcanic glass, magnetite;

(2) *Siliceous organisms* (1 per cent.), including sponge spicules, radiolaria, diatoms;

(3) *Fine washings* (9·88 per cent.), made up of amorphous clayey matter, together with minute mineral particles and fragments of siliceous organisms.

SOUNDING 246.—June 25, 1901, lat. 31° 6′ 49″ S., long. 170° 3′ 44″ E., 2034 fathoms.

Globigerina Ooze, pure white with light brown patches, chalky, coherent; containing—

(a) CALCIUM CARBONATE (88·86 per cent.), made up of small pelagic and bottom-living foraminifera and fragments, pteropod fragments, coccoliths, rhabdoliths, coccospheres;

(b) RESIDUE, after removal of calcium carbonate by dilute hydrochloric acid (11·14 per cent.), grey, consisting of—

(1) *Minerals* (1 per cent.), mean diameter 0·07 mm., angular, a few glassy particles;

(2) *Siliceous organisms* (2 per cent.), including fragments and spicules of siliceous sponges, fragments of arenaceous foraminifera, radiolaria;

(3) *Fine washings* (8·14 per cent.), made up of amorphous clayey matter, with a few minute mineral particles and siliceous fragments.

SOUNDING 295.—July 6, 1901, lat. 34° 36′ 32″ S., long. 173° 35′ 37″ E., 180 fathoms.

Green Mud or Sand, greenish grey, incoherent, gritty; containing—

(a) CALCIUM CARBONATE (30 per cent.), made up of pelagic and bottom foraminifera, echini spines, one or two pteropod fragments, tunicate spicules, coccoliths, rhabdoliths;

(b) RESIDUE, after removal of calcium carbonate by dilute hydrochloric acid (70 per cent.), green, consisting of—

(1) *Minerals* (40 per cent.), mean diameter 0·2 mm., angular and rounded, including quartz, mica, glauconite, felspar, volcanic glass;

(2) *Siliceous organisms* (10 per cent.), including glauconitic casts, sponge spicules, arenaceous foraminifera, diatoms;

(3) *Fine washings* (20 per cent.), made up of amorphous clayey matter and many minute particles of minerals and siliceous organisms.

SOUNDING 297.—July 13, 1901, lat. 34° 29′ 30″ S., long. 173° 36′ 57″ E., 465 fathoms.

Globigerina Ooze, greyish brown, granular, coherent; containing—

(a) CALCIUM CARBONATE (40 per cent.), made up of small pelagic foraminifera (including *Globigerina bulloides*, *G. conglobata*, *G. æquilateralis*, *G. dubia*, *Sphæroidina dehiscens*, *Pulvinulina micheliniana*, *P. canariensis*, *Orbulina universa*), bottom-living foraminifera (*Nodosaria*, *Uvigerina*, *Biloculina*), ostracodes, otoliths of fishes, echini spines, coccoliths, rhabdoliths;

(b) RESIDUE, after removal of calcium carbonate by dilute hydrochloric acid (60 per cent.), brownish grey, consisting of—

(1) *Minerals* (15 per cent.), mean diameter 0·1 mm., angular, including pumice, volcanic glass, hornblende, muscovite, felspar, augite, magnetite;

(2) *Siliceous organisms* (5 per cent.), including clayey casts, sponge spicules, arenaceous foraminifera;

(3) *Fine washings* (40 per cent.), made up of amorphous clayey matter, with minute mineral particles and fragments of siliceous organisms.

SOUNDING 340.—July 20, 1901, lat. 26° 32′ 18″ S., long. 170° 49′ 10″ E., 2290 fathoms.

Globigerina Ooze, light brown, plastic, coherent; containing—

(a) CALCIUM CARBONATE (65·59 per cent.), made up of small and broken pelagic foraminifera (including *Globigerina bulloides*, *G. conglobata*,

G. æquilateralis, *G. dubia*, *G. inflata*, *G. sacculifera*, *Sphæroidina dehiscens*, *Orbulina universa*, *Pullenia obliquiloculata*, *Pulvinulina micheliniana*, *P. canariensis*), bottom-living foraminifera (including *Lagena*, *Uvigerina*, *Nodosaria*), echini spines, ostracodes, coccoliths and rhabdoliths;

(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (34·41 per cent.), reddish brown, consisting of—

(1) *Minerals* (5 per cent.), mean diameter 0·15 mm., including orthoclastic and other felspars, pumice (one fragment measuring 2 mm. in diameter), clear, brown, and green volcanic glass, brown hornblende, magnetite;

(2) *Siliceous organisms* (2 per cent.), including radiolaria, sponge spicules, arenaceous foraminifera, diatoms;

(3) *Fine washings* (27·41 per cent.), made up of amorphous clayey matter, with minute particles of minerals and siliceous organisms.

Sounding 359.—July 22, 1901, lat. 24° 23′ 24″ S., long. 173° 4′ 51″ E., 2475 fathoms.

Red Clay, dark, reddish brown, plastic, coherent; containing—

(*a*) Calcium Carbonate (10·35 per cent.), made up of broken pelagic foraminifera (*Sphæroidina dehiscens*, etc.), coccoliths and rhabdoliths;

(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (89·65 per cent.), brown, consisting of—

(1) *Minerals* (15 per cent.), mean diameter 0·15 mm., angular, including pumice, volcanic glass, felspar, hornblende, magnetite;

(2) *Siliceous organisms* (3 per cent.), including radiolaria, arenaceous foraminifera, sponge spicules;

(3) *Fine washings* (71·65 per cent.), made up of amorphous clayey matter, with minute mineral particles and fragments of siliceous organisms.

Sounding 367.—July 23, 1901, lat. 23° 26′ 59″ S., long. 174° 11′ 28″ E., 2340 fathoms.

Red Clay, chocolate coloured, plastic; containing—

(*a*) Calcium Carbonate (4·10 per cent.), made up of fragments of pelagic and bottom-living foraminifera, coccoliths;

(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (95·90 per cent.), chocolate coloured, consisting of—

(1) *Minerals* (40 per cent.), mean diameter 0·18 mm., angular, consisting principally of fragments of pumice (one piece measuring 3 mm. in diameter), felspar, glassy particles.

(2) *Siliceous organisms* (3 per cent.), including radiolaria, sponge spicules, arenaceous foraminifera;

(3) *Fine washings* (52·90 per cent.), made up of amorphous clayey matter with minute splinters of pumice and fragments of siliceous organisms.

Sounding 381.—July 24, 1901, lat. 21° 55′ 17″ S., long. 175° 29′ 38″ E., 1599 fathoms.

Globigerina Ooze, greyish brown, plastic, coherent; containing—

(*a*) Calcium Carbonate (73·99 per cent.), made up of pelagic foraminifera (including *Globigerina bulloides*, *G. conglobata*, *G. æquilateris*, *G. dubia*, *G. rubra*, *Sphæroidina dehiscens*, *Pullenia obliquiloculata*, *Pulvinulina tumida*, *P. menardii*, *P. micheliniana*, *P. canariensis*, *Orbulina universa*, *Candeina nitida*), bottom-living foraminifera (including *Biloculina*, *Uvigerina*), ostracodes, coccoliths, rhabdoliths;

(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (26·01 per cent.), reddish brown, consisting of—

(1) *Minerals* (5 per cent.), mean diameter 0.15 mm., angular, including pumice, felspar, volcanic glass, magnetite;

(2) *Siliceous organisms* (1 per cent.), including sponge spicules, radiolaria;

(3) *Fine washings* (20·01 per cent.), made up of amorphous clayey matter, with minute mineral particles and fragments of siliceous organisms.

Sounding 420.—July 28, 1901, lat. 19° 36′ 11″ S., long. 177° 17′ 23″ E., 1491 fathoms.

Volcanic Lapilli. The material consists of coarse, angular fragments of greyish black volcanic rock and obsidian; the rock fragments, the largest of which measures 15 × 12 × 3 mm., are vesicular, light in weight, and contain felspar and magnetite crystals set in a glassy base. There are also larger and smaller isolated crystals of augite, with well-defined faces. A few pelagic foraminifera were also observed (including *Globigerina conglobata*, *G. æquilateralis*, *G. bulloides*, *G. dubia*, *Sphæroidina dehiscens*, *Orbulina universa*, *Pulvinulina tumida*, *P. canariensis*, *P. micheliniana*).

It is possible that any fine amorphous clayey matter associated with this volcanic scoriæ at the bottom may have been washed out of the sounding-machine while being drawn up to the surface.

Sounding 441.—July 29, 1901, lat. 18° 10′ 35″ S., long. 178° 23′ 49″ E., 159 fathoms.

Pteropod Ooze, bluish grey, soft, plastic, coherent; containing—

(*a*) Calcium Carbonate (48·27 per cent.), made up of pteropod fragments (including *Clio subula*, *C. australis*), pelagic foraminifera (including *Globigerina bulloides*, *G. conglobata*, *G. æquilateralis*, *Sphæroidina dehiscens*, *Orbulina universa*), echini spines, larval mollusc shells, bottom-living foraminifera (*Biloculina*, etc.), ostracodes, otoliths of fish, coccoliths, rhabdoliths;

(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (51·73 per cent.), greenish blue, consisting of—

(1) *Minerals* (10 per cent.), mean diameter 0·1 mm., angular, including felspar, augite, hornblende, volcanic glass, magnetite;

(2) *Siliceous organisms* (3 per cent.), including sponge spicules, arenaceous foraminifera;

(3) *Fine washings* (38·73 per cent.), made up of amorphous clayey matter with minute particles of minerals and siliceous organisms.

Sounding 487.—August 6, 1901, lat. 15° 11′ 4″ S., long. 176° 45′ 6″ W., 900 fathoms.

Volcanic Mud, brown, granular, coherent; containing—

(*a*) Calcium Carbonate (21·03 per cent.), made up of pelagic foraminifera (including *Globigerina bulloides*, *G. conglobata*, *G. æquilateralis*, *G. sacculifera*, *G. dubia*, *Sphæroidina dehiscens*, *Orbulina universa*, *Pulvinulina menardii*, *P. tumida*, *P. canariensis*), bottom-living foraminifera (*Pullenia sphæroides*, *Lagena*, etc.), echini spines, otoliths of fish, ostracodes, coccoliths, rhabdoliths;

(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (78·97 per cent.), heavy, brown in colour, with black vitreous particles, consisting of—

(1) *Minerals* (45 per cent.), mean diameter 0·3 mm., angular, including volcanic glass, felspar, pumice, magnetite;

(2) *Siliceous organisms* (2 per cent.), made up of arenaceous foraminifera, radiolaria;

(3) *Fine washings* (31·97 per cent.), made up of amorphous clayey matter, with minute particles of minerals and siliceous organisms.

SOUNDING 495.—August 6, 1901, lat. 14° 32′ 36″ S., long. 175° 55′ 10″ W., 1281 fathoms.

Globigerina Ooze, reddish brown, consolidated into small lumps, perforated by worms, the perforations darker brown in colour. Mr. Peake says that the material came up perfectly hard and dry, and required a hammer to knock it out of the tubes; the space between the tubes was quite full, and apparently riddled with what looked like worm-holes; but on attempting to take off the sample it fell to pieces. It contains—

(*a*) CALCIUM CARBONATE (40·59 per cent.), made up of pelagic foraminifera, mostly of small size, bottom-living foraminifera, coccoliths, rhabdoliths;

(*b*) RESIDUE, after removal of calcium carbonate by dilute hydrochloric acid (59·41 per cent.), dark brown, consisting of—

(1) *Minerals* (25 per cent.), mean diameter 0·2 mm., mostly angular, including augite (one crystal 3 mm. in maximum diameter and smaller ones observed), hornblende, magnetite, felspar, volcanic glass, pumice;

(2) *Siliceous organisms* (1 per cent.), a few sponge spicules;

(3) *Fine washings* (33·41 per cent.), made up of amorphous clayey matter, with minute particles of minerals and siliceous organisms.

SOUNDING 510.—August 8, 1901, lat. 13° 35′ 0″ S., long. 174° 13′ 30″ W., 2530 fathoms.

Red Clay or Radiolarian Ooze, brown with darker patches, clayey, gritty; containing—

(*a*) CALCIUM CARBONATE (27·5 per cent.), made up of pelagic foraminifera and fragments, bottom foraminifera, echini spines, fish teeth, coccoliths;

(*b*) RESIDUE, after removal of calcium carbonate by dilute hydrochloric acid (72·5 per cent.), brown, consisting of—

(1) *Minerals* (25 per cent.), mean diameter 0·2 mm., angular, principally fragments of pumice (several fragments measuring 2 mm. in diameter, and one exceeding 5 mm. observed), felspar, volcanic glass, magnetite;

(2) *Siliceous organisms* (10 per cent.), including radiolaria, sponge spicules, arenaceous foraminifera;

(3) *Fine washings* (37·5 per cent.), made up of amorphous clayey matter, with minute particles of minerals and siliceous organisms.

SOUNDING 581.—August 17, 1901, lat. 3° 52′ 26″ S., long. 166° 7′ 46″ W., 2945 fathoms.

Radiolarian Ooze, chocolate colour, plastic, coherent; containing—

(*a*) CALCIUM CARBONATE (2 per cent.), made up of fish teeth, coccoliths;

(*b*) RESIDUE, after removal of calcium carbonate by dilute hydrochloric acid (98 per cent.), chocolate colour, consisting of—

(1) *Minerals* (3 per cent.), mean diameter 0·1 mm., angular, including pumice (one fragment 10 mm. in diameter), volcanic glass, felspar, magnetite, hornblende;

(2) *Siliceous organisms* (40 per cent.), including radiolaria, sponge spicules, diatoms;

(3) *Fine washings* (55 per cent.), made up of amorphous clayey matter, with fragments of siliceous organisms and minute mineral particles.

SOUNDING 625.—August 25, 1901, lat. 3° 53′ 46″ N., long. 159° 24′ 45″ W., 255 fathoms.

Coral Sand, greyish white, granular, incoherent; containing—

(a) CALCIUM CARBONATE (98·55 per cent.), made up of angular fragments of corals and mollusc shells, polyzoa, *Orbitolites*, *Serpula*, echini spines, larval gastropods and lamellibranchs, alcyonarian spicules, tunicate spicules, otoliths of fish, ostracodes, bottom-living foraminifera (*Biloculina*, *Polytrema*, *Amphistegina*, *Pullenia sphæroides*, etc.), pelagic foraminifera (including *Globigerina bulloides*, *G. conglobota*, *G. sacculifera*, *G. æquilateralis*, *Sphæroidina dehiscens*, *Pullenia obliquiloculata*), pteropod fragments (*Clio subula*), heteropods (*Atlanta*);

(b) RESIDUE, after removal of calcium carbonate by dilute hydrochloric acid (1·45 per cent.), brown, consisting of a few grains of felspar and volcanic glass, one or two sponge spicules, and a very little amorphous clayey matter.

SOUNDING 664.—August 30, 1901, lat. 8° 15′ N., long. 157° 7′ 50″ W., 2760 fathoms.

Radiolarian Ooze, brown, plastic, coherent; containing—

(a) CALCIUM CARBONATE (20·99 per cent.), made up of broken pelagic and bottom foraminifera, echini spines, coccoliths;

(b) RESIDUE, after removal of calcium carbonate by dilute hydrochloric acid (79·01 per cent.), brown, consisting of—

(1) *Minerals* (2 per cent.), mean diameter 0·1 mm., angular, including volcanic glass, felspar, hornblende, magnetite;

(2) *Siliceous organisms* (30 per cent.), including radiolaria, sponge spicules, arenaceous foraminifera, diatoms;

(3) *Fine washings* (47·01 per cent.), made up of amorphous clayey matter, with minute particles of minerals and siliceous organisms.

FROM THE YANG-TSE KIANG TO THE CHINA SEA.*

By WM. BARCLAY PARSONS, C.E.

THE Chinese Empire has never been completely and accurately surveyed, although native maps exist purporting to give a delineation of the whole country. While such sources of information are sufficiently approximately correct to show the geography and the topography for ordinary purposes, it is only as surveys are made under foreign auspices that we are enabled to get the true location and description of details. Such foreign surveys naturally follow the trade routes—that is, the coast-line and inland waters. When the latter have all been correctly plotted we shall have secured the topographical skeleton, to which the less important details can be readily connected. This paper, with its accompanying map, gives a description of two important waterways which hitherto have never been accurately surveyed.

Of the primary lines of drainage of China there are three, all of

* Map, p. 788.

which have an easterly course, draining as they do the eastern flank of the Asiatic upheaval. These rivers are—the Si (West) river in the south; Yang-tse in the centre; and the Hoang (Yellow) in the north. The largest and in every way the most important of the above is the Yang-tse, which includes within the limits of its watershed more than one-half of the area of the empire proper. The Yang-tse itself has been described so often and so minutely from its upper waters to the sea that all description of it will be omitted here except to recall that its length is about 3500 miles, with a width at the mouth of 7 miles, and that it is navigable for steam-vessels as far as I-chang, 1100 miles, and for ocean-going vessels for 700 miles, as far as Hankau. The author is aware that a steam-launch has been taken 500 miles above I-chang, as far as Chung-king, through the energy of Mr. Little, but not wholly so under her own steam, as the united strength of several hundred coolies was necessary to tow her up the rapids, and more recently the experiment has been repeated with a flat-bottomed British gunboat. Whether or not the Yang-tse above I-chang can ever be improved so that it will be a navigable stream is a question still unanswered. The greatest traffic to and from Hankau is during the summer, when tea is being shipped, and during which season the depth of water ranges from 30 to 50 feet, according to the condition of the flood. The minimum stage of the river occurs usually in December, when a draught of about 11 feet is all that can be counted on below Hankau.

The Yang-tse has three important tributaries—the Kan, the one nearest the sea, draining the province of Kiang-si, and flowing into the Yang-tse through the Po-yang lake at Kiu-kiang, 520 miles from the sea. The next tributary is the Han, flowing south into the Yang-tse at Hankau (literally Han-mouth), draining portions of the provinces of Hu-peh, Shen-si, and Ho-nan. Proceeding westerly, the next tributary is the Siang, a river second in importance only to the Han, flowing from south to north, and joining the great river at the Tung-ting lake 150 miles above Hankau, or about 850 miles from the sea, following the sinuosities of the Yang-tse. It is with the Siang-kiang and its chief tributary, the Lei-ho, and the Pei-ho and its tributary the Wu-shwei on the south side of the Nanling range which separates the Yang-tse drainage from that of the China sea, that this paper will deal.

From time immemorial the Kan and the Siang rivers, with the Pei-ho, have constituted the chief highways between south and central China. Canton is to-day, and always has been, the seat of manufacturing industry, so that the term "Canton article" has become synonymous with "manufactured article." Canton has also been China's chief gateway for external trade. It was from Canton, long before the days of Marco Polo, that venturesome traders are supposed to have sailed around India, and so to have carried silk to Europe. Even at the present time,

of all Chinese the Cantonese are the shrewdest traders and the greatest travellers. Between such a point and other parts of the empire direct and reasonably easy communication was necessary. Three routes presented themselves, of which two had a common stem at the south end in the Pei-ho (North river) from Canton to Shao-chau, while the third followed the Si-kiang (West river) to Wu-chau, and thence the Kiu kiang northward. From Shao-chau the easternmost of the three routes lay along the Pei-ho to the Nanling range, which last named was crossed by a portage over the Meling pass. On the north side of the range the waters of the Kan-kiang were reached, and were followed to the Po-yang lake and thus to the Yang-tse. This was the route usually

DESCENT FROM CHELING PASS TOWARDS CHINA SEA.

taken in going from Canton to Peking; for from Kiu-kiang it was a short and easy journey by the way of the Yang-tse to Yang-chau, the southern terminus of the Grand canal. It was by this route that the celebrated embassy, headed by Lord MacCartney, journeyed in 1793 from Peking to Canton. The most western of the three routes crossed the Nanling range at a point where the range is so low that a canal has been constructed connecting the waters of the valley of the West river with those of the Siang.

The central route, known as the Cheling, is the most important. This route follows the Wu-shwei, a tributary of the Pei-ho, from Shao-chau to the head of small boat navigation at I-chang (not to be confounded with I-chang at the head of steam navigation on the Yang-tse),

whence there has been constructed a paved highway leading over the range *viâ* the Cheling pass to Cheng-chau, at the head of navigation on the Lei-ho. As the last is a branch of the Siang, the Cheling leads directly to the Yang-tse and Central China. The length of this highway is about 90 Chinese "li," or 30 English miles, with an elevation of about 750 feet to overcome. Of the three routes, the Cheling has undoubtedly carried the greatest traffic, on account of the better outlet to the north and of its superior water facilities, the Siang being a larger and more easily navigated stream than the Kan. The time when this route was first established, or when and how the highway was first laid out and paved, is quite uncertain. Undoubtedly it is of great antiquity. As a mere trade route, it is probably coeval with the first exchange of commodities between the Yang-tse valley and the region of the China sea. Then, as traffic grew, the land portage was paved, houses for the entertainment of travellers, and for the housing of pack-coolies and ponies, were established. Such houses were, for convenience and mutual protection, grouped into detached villages, and finally these villages grew together, so that the highway became lined with inns, shops, and stables almost continuously from end to end. During the two, three, or more thousand years of the existence of this route an enormous tonnage, both north and south, has passed over it. With the opening of the Yang-tse to steam navigation in 1860, the glory of the Cheling highway began to fade, as it was found more profitable to ship goods between central China and Canton by way of the Yang-tse and the ocean, so that to-day, although the traffic is still considerable, many of the buildings that were once necessary to supply the needs of the traveller or the coolies are now abandoned and are dropping to decay. Curiously enough, in spite of its importance as a trade factor, but little in the way of accurate information has been known of it, and that little has come chiefly from native sources. This lack of information is owing to the peculiarity of the people living in Hu-nan, the province immediately to the north of the mountains. In this province the Chinese characteristic of exclusiveness has reached its maximum development, so that foreigners have been prevented from entering it. In fact, this spirit of exclusiveness has been so strong that even Chinese other than those of Hu-nanese origin have not been welcome, so that in my recent journey about to be described considerable difficulty was experienced in getting Chinese attendants. On this account Hu-nan has earned the title of the "closed province," and Chang-sha, its capital, has divided honours with Lhasa in Tibet as never having been polluted by the presence of a "foreign devil." Attempt after attempt has been made by missionaries to gain a lodgment in Hu-nan, but always ineffectually, except in the north-western corner, where the people are more kindly disposed, and in the southern part at Heng-chau, where, singular to state, a Roman Catholic post was established nearly two hundred years ago, and which since

then has successfully withstood many an attack, receiving reinforcement from time to time by boat up the Siang.

For maps and geographical knowledge on this interesting and important section of China we have had to depend on Chinese surveys, which, it is almost needless to add, are quite inaccurate and incomplete. No thorough or accurate survey has been made previous to the one of which this paper is the record. Four careful observers have been over the route in whole or part, but, their journeys having been confined to boat travel, they noted those things only which could be examined from a moving junk. Dickson, in 1861, was the first foreign traveller to go from Canton to the Yang-tse; and was followed by Raphael Pumpelly, an American geologist, who in 1865 endeavoured to explore the Siang valley, but who, on reaching Chang-sha, was forced to return without having been permitted to land. In 1869 the Chamber of Commerce of Shanghai commissioned Baron Richthofen, the celebrated German geologist, to examine the province of Hu-nan with special respect to its coalfields. Von Richthofen started at Canton, went northward over the Cheling, and then continued his course along the Siang and its tributaries until he reached the Yang-tse. Like Pumpelly, he was forbidden to go ashore. In 1878 Mr. G. J. Morrison, an English engineer, started from Hankau to explore Hu-nan on foot. On reaching the borders of the province, the officials insisted on his embarking on a junk, by which means he continued southward, finally reaching Canton. The observations of these travellers have been recorded, those of the last through a paper read before the Royal Geographical Society. Their records, however, were necessarily approximate and incomplete.

At the close of the year 1898, the writer, with a properly equipped staff, started from Hankau to make a continuous instrumental survey along the Cheling route to Canton, in order to determine its suitability for railroad purposes. This, in spite of difficulties, urged by the Chinese and seconded by the foreigners, was successfully accomplished, thus completing the first land journey. The survey line as run was 742 miles in length, in addition to which reconnaissance work covered about 400 miles more. Of the total distance, at least 500 miles were through a district where no foreigner had ever been seen, and an entrance into and an official reception in Chang-sha were obtained. The survey itself was the longest survey hitherto completed in the Chinese Empire. Measurements were made by means of a tacheometer transit, with a vertical circle and solar compass attachment, so that angles in azimuth and altitude were measured, determining horizontal distances and altitudes. By means of the solar compass the variation of the magnetic needle was frequently measured. The determination of the position of the line of zero magnetic variation was a matter of special interest, in order to get a suggestion as to its probable trace across China. The survey began from the known longitude and latitude at Hankau, and

closed on that of Canton. The final error was about half a mile, or an error of 1 in 1500, a much closer result than could be obtained with a chain.

The course of our journey passed through three provinces, Hu-peh in part, the length of Hu-nan, and across Kwang-tung from its northern boundary to Canton. Hu-peh, so far as this paper is concerned, will be passed over with a few remarks. The Yang-tse kiang has been already surveyed and mapped, and the province of Hu-nan has been quite fully explored. The survey herein described, so far as it relates to Hu-peh, will suffice to locate a chain of lakes that is to be found between the Yang-tse and a range of hills that runs parallel with the Yang-tse 10 to 15 miles away. These lakes and the scattering villages have been shown only on Chinese maps, and then, as we found more than once to our great discomfort, sometimes very far from their true location.

From Hankau to the Tung-ting lake the banks of the Yang-tse preserve the same general characteristics that prevail between the sea and Hankau, viz. a plain on the north or left bank, and a broken surface on the south. The annual rise of the river at Hankau varies from 40 to 50 feet, a rise sufficient to top the banks at nearly all points west of Hankau. To prevent lands from being overflowed, the several localities are organized into districts in order that the inhabitants may unite to construct dykes to protect their common interests. These dykes are very irregular in plan, but in cross-section have a width on top of 6 to 10 feet, side slopes of about two horizontal to one vertical, and a height as great as 15 feet at times, though the average seemed to be about 8 feet. As a general thing, they are not paved or revetted on the slopes. Along this part of its course the Yang-tse resembles the Mississippi and other alluvium-carrying streams, in that it builds up its banks. The highest land was frequently found next to the river, whence it falls inland at a rate in some places as great as 1 in 125, or 1 in 100, until a range of hills is reached 10 or 15 miles south of the river-bank. Wherever the dykes fail, or the flood waters can get around them, the back lands are therefore more deeply flooded than those next to the river. For this reason the main highway has been constructed along the sides of the hills well above the level of the low lands.

The chief crop raised in this section is rice, which is consumed mostly at home. Other products are beans, cotton of coarse and short staple, and bean oil. Bricks are manufactured. Coal is found, but, on account of the high proportions of sulphur and ash, is worked to a very limited extent for local consumption only.

With Hu-nan there is a greater interest attaching, as this province, as already explained, presents virgin soil to the investigator. Hu-nan has an area of approximately 75,000 square miles, extending between the 25th and 30th parallels of latitude, and the 109th and 114th meridians

of longitude east of Greenwich. The population is placed, according to native official reports, at from 20,000,000 to 22,000,000.

The Yang-tse kiang marks the northern boundary, but nearly the whole of the surface of the province lies within the drainage areas of two rivers, the Siang and the Yuen. There are two other streams apparently independent, but which actually are tributaries of the first two, viz. the Li shwei and the Tse kiang. They both flow into the Tung-ting lake when it is a lake, but at other seasons the Li shwei joins with the Yuen and the Tse with the Siang. The Siang kiang, with its tributaries, have their headwaters on the northern flank of the Nan-ling mountains, which range, under several aliases, forms the divide

LEI-HO, NEAR LEI-YANG.

between the Yang-tse valley and the China sea. The valley of the Siang covers, therefore, the southern, central, and eastern portions of Hu-nan. The Yuen kiang rises in Kwei-chau, and drains western Hu-nan. In relative importance the Yuen is much inferior to the Siang, both in point of view of area drained, navigability, and as a trade route.

The Siang and the Yuen join in what is known as the Tung-ting lake, or, strictly speaking, what becomes the Tung-ting lake at certain seasons of the year. Owing to a recession of the hills that from Tibet seaward mark the south bank of the Yang-tse, the great plain formed by that river extends southerly into Hu-nan, a distance of 60 miles, so as to give the appearance of an alluvial delta deposited

by the Siang and Yuen rivers. This deposit, however, is of Yang-tse origin, as neither of the other streams flows through an alluvial soil. In winter, when all central and southern Chinese streams are at their low stage, the Siang and the Yuen cut through this alluvial plain in sharply defined beds, with banks 15 to 20 feet above the water-level. These streams are about half a mile wide, and 5 to 6 feet deep. When the rivers reach their summer flood, the whole plain is overflowed and a lake appears, through which the river-beds are but channels. This lake extends 60 miles south from the Yang-tse, and parallel to it for 75 miles. On the plain or lake-bed an attempt is occasionally made to raise an early spring crop, but such use is very limited. Along the channel banks are each year constructed settlements in mat shed houses, where junk men can obtain supplies, and near which, for mutual protection from thieves, junks tie up during the night; for, owing to the entire lack of beacons, buoys, or other aids to navigation, and on account of the frequency and variable character of shoals, all river travel is confined to daylight hours.

With the exception of this lake-plain the other parts of the province are mountainous, valley bottoms being, as a rule, small and narrow. On the east, the boundary between Hu-nan and the adjoining province of Kiang-si is marked by a range of hills rising steadily from the Siang, whose tops have an altitude of 2500 feet above that stream; on the south, the Nanling range, with peaks 5000 to 6000 feet above sea-level, separates Hu-nan from Kwang-tung; while on the west a less important upheaval divides Hu-nan from Kwei-chau.

The province is therefore a rectangular basin draining to the north. Rising in the south-west corner of the basin, and receiving the drainage from the north slope of the Nanling range, is the Siang kiang. At first its course is north-easterly to about long. 112° 30' E., whence it turns and flows due north to the Yang-tse. In character the Siang differs entirely from its outfall the Yang-tse, although like the Yang-tse it is subject to violent rise during the spring and summer. Here the similarity ends. By far the greater part of the watershed of the Siang is mountainous and rocky, and of alluvial soil or soil easily subject to erosion there is little or none. The waters of the Siang are therefore comparatively clear. At lat. 26° 57′ N., long. 112° 35′ E., the Siang receives the waters of the Lei-ho, a stream flowing due north from the Nanling mountains, and whose size is as great as that of the Siang where the two join, but whose importance, from a commercial standpoint, is decidedly greater. The upper waters of the Siang and the Lei are contained in sharply defined and somewhat narrow valleys where the hills run, as a rule, direct to the streams, leaving but little level area along the banks, thus holding the streams to fixed courses and preventing change in bed, so frequently encountered with other Chinese streams.

The general course of the Lei is fairly direct and almost due north. Its upper waters consist of two streams, both of which rise in the Nanling mountains, and of which the easterly one bears the name of Lei, and the westerly that of Yu-tan. The latter is the more important, and it was traced to its source. The Yu-tan has its rise in the main pass in the Nanling called the Cheling, at an altitude of about 1000 feet above the sea-level. In a distance of 18 miles it has a fall of nearly 500 feet to Cheng-chau Fu, a prefecture town, and the most important in southern Hu-nan. Above Cheng-chau the stream is not navigable, the fall being too great, and the depth of water during the greater part of the year being insufficient. Northward, however,

FEI KIANG.

Cheng-chau marks the head of navigation, and the point of transfer between boat and portage over the Cheling highway. In mid-winter, when the rain is usually at the minimum, the depth of water on shoals between Cheng-chau and Yung-hsing, 58 miles, will not exceed 6 to 12 inches, so that for two months in dry years heavily laden south or up bound junks are compelled to discharge in whole or part at the latter point. The fall of the stream between Cheng-chau and Yung-hsing is 130 feet. During the spring, summer, and autumn the river rises so as to have an average depth of from 3 to 4 feet, and with this increase in depth the current becomes very swift.

Below Yung-hsing there is a regular communication at all times of the year for junks whose draft does not exceed 12 inches, and the Lei

assumes the character of a river. Its width at Yung-hsing is about 130 yards, which is gradually increased as the junction with the Siang is approached. From Yung-hsing northward the rate of fall decreases. Between Yung-hsing and Lei-yang, the only other point of importance on the stream, a distance by river of 34·5 miles, the total descent is 60 feet, and between Lei-yang and the Siang kiang, 50 miles, it is 80 feet. From Lei-yang northward the available depth of water at an ordinary minimum is 15 inches.

With the exception of the Yu-tan, there are no streams flowing into the Lei that are navigable at all times. The Fei kiang and the Cheng kiang are the chief tributaries. The former reaches an excellent deposit of anthracite, one of the few hard anthracites that we found, and the latter the bituminous field of Shing-ning. In the spring, summer, and autumn there is enough water to permit light junks to be drawn up against the current to bring down loads of coal. In the winter-time the shipment of anthracite from the upper Fei is suspended, the country being too rough to permit the coal being carried out on coolies' backs. Shing-ning, however, having fairly good paths, is able to continue shipping regardless of the stage of water.

On reaching the Siang the Lei joins a river about its own size, so that northward from this point there is a stream of more generous proportions, with a course almost due north, and where the limits of the drainage area recede on the east and west to the provinces of Kiang-si and Kwei-chau.

The banks of the Siang are less steep than those of the Lei; the hills in intermediate contact with it are less pronounced, and consequently there is found a greater extent of river "bottom" or arable lands.

The width of the Siang immediately below the junction is about 370 yards. At Lu-kau, the mouth of the Lu, its chief influent from the east, 85 miles from the mouth of the Lei, the width has increased to 470 yards, and at the Tung-ting lake to 850 yards. All of the above widths represent approximate width between banks at low-water stage.

The fall of the Siang between Lei-kau and Lu-kau is about 0·7 foot per mile, and below Lu-kau slightly less. The depth of the river on shoals available for navigation is variable, owing to the shoals themselves shifting at every flood. In general it can be said that junks drawing 5 feet of water can reach Yo-chau at all seasons. Between Yo-chau and Siang-yin 4 feet of draft can be counted on, except at one point in the Tung-ting channel, where the alluvial deposit is apt to collect during the winter, and so reduce the depth of water to 2 feet. I navigated it, however, in a junk drawing 3 feet without trouble. A very small amount of annual maintenance would give a minimum depth of 4 feet. Between Siang-yin and Siang-tan boats drawing 3 feet can proceed during the low-water stage in January, but with difficulty.

Above Siang-tan the presence of a large shoal in the great bend of the river reduces the navigable depth to not exceeding 2 feet. This shoal places Siang-tan at the head of large-junk navigation. Between there and Heng-chau the minimum depth falls to 18 inches, and above that point only very small junks or san-pan can proceed at all. These figures represent extreme low water in mid-winter. With the spring rains the river rises so that the flood depth at Lei-kau is probably 10 feet, increasing to 30 feet at Yo-chau. As a general thing the banks of the river are sufficiently high to be above flooding. Occasionally, and usually at points of influx of other streams, areas were found so low as to be subject to inundation. As such land is generally fertile and worth cultivating, the natives project the same by levees. As these low lands are not continuous, the protecting levees are local, and do not form, as is frequently the case along the Yang-tse, an extended system.

The course of the Siang is fairly straight and free from the great bends that we find in the Yang-tse, and which lengthen navigation on that stream. Between Heng-chau and the Yang-tse there is but one large *détour*—that of the Siang-tan bend caused by the hills at Chu-chau deflecting the river to the west. In the Tung-ting lake the channel through the alluvial deposit is very tortuous, owing to the shifting character of the soil.

The eastern part of the province of Hu-nan rises steadily from the Siang to the border of the province. Draining this watershed there are four principal streams flowing into the Siang above the mouth of the Lei, of which the largest are the Lu and the Mi or Chao-ting.

The important towns in Hu-nan, as in other provinces, are located on the waterways. The first one to be reached on leaving the Yang-tse is Yo-chau, situated 5 miles from the former and at the outlet of the Tung-ting lake. In 1899 Yo-chau was declared a treaty port, and a custom staff was assigned to the post. No business has been done, as the "Boxer" outbreak followed shortly afterwards. Yo-chau contains a population of possibly 40,000, is walled, and has a long gently sloping foreshore, on which junks can be conveniently beached at any stage of the river. Situated as it is at the north end of the Tung-ting lake, it is the gateway to the province, for all the in and out traffic of all rivers in Hu-nan must pass by it. The commercial importance of Yo-chau is therefore assured. The topography of the surrounding country is such that a foreign settlement can be easily built along the river-bank, either above or below the Chinese city.

Siang-yin (lat. 28° 40′ 30″ N., long. 112° 56′ E.), a walled city of perhaps 20,000 people, stands at the south end of the Tung-ting lake, 60 miles from Yo-chau. At times of high water the place becomes an island, as the river floods the country in the rear. In order to prevent its being entirely cut off, a masonry causeway has been constructed, connecting the city, which is above flood-level, with the hills behind it.

Chang-sha (lat. 28° 12′ N., long. 112° 59′ E.), the capital of the province, is like Siang-yin on the east bank, 45 miles south by the river from the latter. In many ways Chang-sha is one of the most interesting places in China. Of all Chinese cities it is the most anti-foreign. No missionary and but one or two foreigners have ever succeeded in getting within its walls, and even those foreigners who did get in, did so either surreptitiously or at night. After lengthy negotiations, the writer of this paper succeeded in persuading the governor to receive his whole party at a formal audience with all Chinese etiquette in the governor's yamen, the first foreigners to be so treated. The city is completely walled, although houses built between the wall and the river-front cut off any view of the wall from the river-side. The circuit of the wall is 6 miles, being substantially rectangular in plan, with a length of 2 miles, and a width of 1 mile. The Chinese claim 1,000,000 or more as the number of the inhabitants, but such claim, as with most other figures of Chinese population, I believe to be a gross exaggeration. Probably 500,000 is a better figure.

The streets are of the usual Chinese type—narrow, but well paved, and the houses for the most part are well built. The shops seemed to be generously supplied with all kinds of goods, both native and foreign. Many of the latter that I saw were not only of the regular line of staple goods, such as cottons, kerosene oil, lamps, umbrellas, timepieces, etc., but articles that one would scarcely expect to find in a city where no foreigners resided, such as American tinned vegetables and fruits, and English and German beer. As a further indication of the demand for foreign articles can be noted the establishment of a branch of a well-known firm of English chemists of Hong kong and Shanghai. This branch is in charge of a Chinese attendant, who, while he cannot compound foreign medicines, nevertheless sells all the ordinary preparations. We were able to replenish part of our stock of medicines and foreign goods in this most anti-foreign city. In addition to its importance as the provincial capital, and therefore the official residence of the governor and other high provincial officers, Chang-sha is a flourishing manufacturing centre in wooden articles, principally furniture and coffins, in silver and pewter ware and paper. When the present Emperor was first in power, he appointed as governor of Hu-nan a liberal and advanced official named Chen Pao-cheng, who endeavoured to overcome the antipathy of the Hu-nanese to foreigners. He founded what are called "foreign" schools, namely, those where science and modern subjects are taught, inviting Chinese teachers to come from Shanghai for this purpose, and even went so far as to instal an electric-light plant and a telegraph-line. With the advent of the Empress Dowager to power, Chen Pao-cheng was dismissed, and Yu Lien-san, a conservative, was put in power, who immediately set about to undo what his predecessor had begun in the way of reform. As a singular

SANDSTONE FORMATION OVERLYING SHING-NING COAL-MEASURES.

indication of the value of modern science as an agent of reformation, the electric light, having demonstrated its practicability and its advantages, was not only allowed to remain, but was actually extended. Chang-sha therefore presented the curious anomaly of being the most hostile city to all foreign ideas, and yet using one of the few foreign inventions which does not claim previous Chinese origin.

Siang-tan (lat. 27° 54′ 30″ N., long. 112° 51′ 30″ E.) lies by the river 30 miles south from Chang-sha, and situated at the great bend in the river. The original city of Siang-tan is quite small, as indicated by the wall, containing the several official yamen, some large temples, and a few buildings. The great shoaling of the Siang just above Siang-tan, forced upon the city a peculiar prominence as soon as the Hu-nanese began to trade with other ports of the empire. Junks capable of navigating the Yang-tse can ascend the Siang as far as Siang-tan, where the cargoes are transhipped to smaller boats capable of ascending the several rivers above that point. In like manner, coal and other Hu-nanese products arrive at Siang-tan in small lots, and are there combined into larger cargoes for outward shipment. This necessity for transhipment naturally developed commerce by wholesale on the part of native Chinese, who purchase cargoes of imported goods, and hold them at Siang-tan until re-sold in smaller consignments for interior points. Siang-tan has thus become a great distributing metropolis. The new or commercial city has extended itself northward from the old walled city along the river-bank for a distance of 3½ miles, so as to give the maximum of access to the trading junks, which form a solid mass as they lie side by side against the shore. Parallel with the river are two business streets, and, back from them, minor streets and residences. The width of the city does not exceed half a mile. On account of its elongated shape, giving an exaggerated impression of size, and of the large amount of business which is transacted, only a small portion of which is local, Siang-tan has earned the reputation of being very populous, estimates of the number of inhabitants ranging from 1,000,000 to 3,000,000. Having had an opportunity to inspect the city, and having ascertained its thin width, I am forced to doubt whether the population exceeds 600,000. But as to its commercial activity and importance there is no question. Its shops are as well, if not better, provided than those of Chang-sha, and unquestionably a larger business is transacted, but the business, as explained above, is almost wholly one of commission, and there is none of the producing or manufacturing activity that is so manifest at the provincial capital.

Above Siang-tan the cities of note are: Heng-chau (lat. 26° 56′ 30″ N., long. 112° 35′ E.), with a population of 20,000, at the limit of navigation for boats drawing over 12 inches; Lei-yang, on the Lei-ho, the centre of the coal district of southern Hu-nan, with perhaps 4000 to 5000 population; Cheng-chau, already described as point of transfer

from boats to the Cheling highway, containing 5000 population; Li-ling, on the Lu-ho, the chief distributing point of central eastern Hu-nan, a city of considerable commercial activity, with a population of 20,000; and in south-eastern Hu-nan, the cities of Yu and An-jen, with 4000 and 2500 each. The only other city of importance in Hu-nan is Chang-te, at the head of junk navigation on the Yuen kiang. It bears to north-western Hu-nan the same relation that Siang-tan does to central, but it is neither as large nor as important, since the north-western section of the province is less prosperous than the central. Its population is estimated by the natives at various figures from 100,000 and upwards.

SHING-NING COAL DISTRICT.

From an economic geological point of view, Hu-nan invites attention chiefly through its coal-measures. As no systematic investigation of the province has ever been made, it is still impossible to give complete details.

The only notes hitherto obtainable on the geology of the province are those of Richthofen. His observations, however, were made wholly from boats. The rocks of the northern part of the province are of soft sandstone. At some point near Siang-tan the coal-measures begin, extending easterly to the boundary between Hu-nan and Kiang-si, and westerly to an unknown extent. The whole of the province east of the Siang kiang and south of Siang-tan is underlaid with coal.

The greater part of Hu-nan coal is anthracite, and as the natives prefer to burn what they call a non-smoky coal in their chimneyless

houses, no great effort was made until very recently to explore the bituminous deposits. Richthofen, in fact, has stated that the southern field was wholly anthracite, and that although the Siang river field was bituminous in character, it was of very inferior quality. In these statements he erred, due, in the first instance, to his not being allowed to land to explore the field in detail; and, in the second instance, to the fact that bituminous coals were not specially sought after, and therefore not developed.

Taking up first the coal-fields in the north, the most important deposit so far discovered is that in the neighbourhood of Ping-hsiang. This city, with a population of 30,000, is situated, not in Hu-nan, but in Kiang-si. Since, however, it lies within the Siang basin, and consequently has an outlet *viâ* the Siang kiang, it can be considered as Hu-nan coal. This Ping-hsiang coal is coking bituminous of a very high grade, showing on analysis fixed carbon varying from 55 to 67 per cent.; volatile carbon, 30 to 25 per cent.; ash, about 8 to 10 per cent., with moisture and sulphur both low, the latter, in fact, being much less than 1 per cent. As the coke is strong and compact, this is evidently a fuel that can be used for steam and metallurgical purposes. There are at Ping-hsiang five known seams, two of which have a thickness of 5 to 6 feet each, while the others are thinner, varying from 2 to 3 feet. They dip to the south-west.

Samples of coal said to be mined near Siang-tan were obtained, which on analysis proved to be bituminous, with 53 per cent. fixed carbon and 30 per cent. volatile matter. This would seem to indicate that the bituminous deposit extended from Ping-hsiang to the Siang kiang. South of this the coals generally change their character, the proportion of fixed carbon increasing, and of volatile matter decreasing, so that from the bituminous the variety passes through semi-anthracite to anthracite. The exposed rocks also change their appearance from sandstone to limestone and shales.

In eastern Hu-nan, along the road leading south from Li-ling through Yu and An-jen, coal is mined for local consumption. Apparently the whole of this part of the province is coal-bearing, but no extensive development work has been done. Such coal as is mined is anthracite.

The great coalfield of Hu-nan, and which has made the province famous, is the Lei-ho field, which extends southerly from the junction of the Lei and Siang rivers, and covers the Lei valley. This coal, being easily mined and having water transportation facilities at hand, has been worked for a great many years, and has found its way to all points, not only in the Siang valley, but along the Yang-tse as far as Shanghai. As it has been chiefly anthracite, the term Hu-nan coal has become synonymous with that variety, and it is likely that coals that have come from other parts have been and are sold under the trade name of "Hu-nan coal."

From Yung-hsing northward the native rocks are mostly shales, all much disturbed, with a dip usually varying from 20° to 40°, although in some instances it was found vertical. The seams outcrop above drainage, and have a thickness varying from 5 to 10 feet, although one seam was reported to have a thickness of 20 feet. These seams are attacked at the outcrop, and worked downward by means of a drift about 4 to 5 feet square, the coal being dragged up the incline in baskets by coolies. No side drifts are made, but the main one is carried down until either water is reached, which, on account of the lack of pumps, presents an insuperable obstacle to further progress, or until the depth is too great for men to be able to carry up the coal, when

PARSONS GAP. DIVIDE BETWEEN YANG-TZE VALLEY AND CHINA SEA.

operations are stopped, and the so-called mine is abandoned. In composition these coals contain from 70 to 80 per cent. fixed carbon, with ash from 9 per cent. upwards. On account of the very disturbed condition of the rocks, all the seams have been subjected to a grinding action, so that, unfortunately, most of the coals are of a very friable nature, crumbling easily into dust. In the estimation of the Chinese this is not a serious fault, as they break up all coal into fine particles and mix them with clay into balls about 3 inches in diameter before the coal is retailed. It is, therefore, quite possible that a thorough systematic examination will show deposits of hard coal which have been neglected in favour of the softer kinds. One such coal attracted my attention—a very hard anthracite found 10 to 12 miles up the Fei

kiang from the Lei-ho. This coal lay at the apex of an anticlinal axis, nearly horizontal, and therefore but little disturbed. Analysis showed it to contain 86 per cent. fixed carbon, about 3 per cent. of volatile matter and moisture, less than 6 per cent. ash, and only 0·2 per cent. sulphur. Its chemical and physical qualities would permit its use direct in a blast furnace according to American practice. Although every little town on the river-bank north of Yung-hsing is a coal-shipping point, the centre of the industry is at Lei-yang, a name sometimes applied to the whole district.

South of Yung-hsing a marked geographical change occurs. The shales, as the surface rock, disappear, their place being taken by a hard red sandstone in thick strata. When first found on going south from Yung-hsing, these strata dip to the south-east at an angle of 30°. In a distance of about 5 miles, during which the angle of dip is gradually decreasing, a synclinal axis is reached, when the dip changes to the north-west with a constantly increasing inclination. After crossing this formation for a distance of about 10 miles in a straight line, a range of hills averaging 2000 feet in height is met, whose direction is north-east—south-west. In this range, and beneath the sandstone, is a deposit of bituminous coal.

Mining operations in this field have been carried on for more than a hundred years, so that the existence of the deposit has been thoroughly established. Apparently it is a small basin in the midst of the large anthracite deposit, for coal of the latter variety is found on all sides. The basin, which goes by the general name of Shing-ning, but whose chief village is San-to, has a known length of at least 13 miles, and a width unexplored, as no deep borings have been made. There are said to be seven veins, whose thickness varies from 2 to 10 feet, with a "strike" north-east—south-west, and a dip to the north-west at an average angle of apparently about 20°. The coal burns freely with a long flame, and produces a strong coke. On analysis the fixed carbon was found to vary from 58 to 74 per cent.; the volatile matter from 14 to 19 per cent.; and the ash from 9 to 25 per cent. More careful mining and the washing of the coal would materially reduce the last. As all the mines are worked from the outcrop, it is possible that deeper operations would develop a more compact and cleaner fuel.

South of the Shing-ning district to the line between Hu-nan and Kwang-tung anthracite is again found, with fixed carbon averaging 78 per cent., volatile matter 10 per cent., ash 9 per cent., and moisture 3 per cent. All the deposits so far opened produce a coal that crumbles into dust, and which can be burned only by mixing with clay according to Chinese practice, or be compressed into briquettes.

The Hu-nan coalfield is very extensive, and contains an enormous tonnage of coals of different varieties. It needs careful, thorough, and

systematic exploration with a diamond drill, for it is probable that the most valuable deposits will be found below the surface, where they may be more compact.

The topography of Hu-nan presents a much-broken surface. With narrow valleys and limited areas of lands capable of being irrigated, Hu-nan does not rank as a province of agricultural wealth, except in the north-eastern portion. The most valuable crop is tea, grown chiefly to the east and north-east of Siang-yin, and which, when gathered, finds its way from the Hu-nan farms to the market-towns on the Yang-tse, or to Hsin-tien on the border-line between Hu-nan and Hu-peh, where it

RANGE AT NORTH END PARSONS GAP.

is bought by Chinese buyers and shipped by junk to Hankau. Inferior grades of tea are grown elsewhere in the province, but chiefly for local consumption, except in the neighbourhood of Cheng-chau in Southern Hu-nan, whence it is sent to Canton. Other crops are rice, raised everywhere in the province wherever suitable irrigation can be obtained; cotton, tobacco, vegetables for local consumption, and, in the south, oranges in great quantity and of excellent quality. The most fertile portions of the Siang valley are in the vicinity of Siang-tan and along the Lu-ho. It is in the latter district that rice is raised in sufficient quantity to supply local need and be shipped. More than 600,000 piculs, or say 40,000 tons, are shipped annually to points outside of Hu-nan.

In previous years the rough hillsides of southern and western

Hu-nan furnished great quantities of timber, and although the large trees have long since been cut, extensive rafts of small second-growth timber are frequent sights on the Tung-ting lake or on the Siang. It was interesting to note that the natives are beginning to recognize the value of growing timber, and that tree-farms on an extensive scale were seen in several places, but chiefly in the vicinity of Siang-yin. The pine, probably on account of its rapid growth, was in each case selected as the tree to be raised. Some of the trees had almost reached a point where they would pay to cut. That arboriculture had proved itself to be a successful venture was indicated by the quite general setting out of young plants. So much of Hu-nan is unsuited for farming, but is adapted for forestry, that it is safe to predict that the thrifty Chinese will, when they are convinced of the financial return, devote a very large proportion of the surface of the province to tree-farms. Another—in fact, one might say the only other—use to which the hillsides are put, except, of course, in those districts capable of raising tea, is for the growing of the tea-oil plant (*Camellia sasanqua*), a shrub with a height of about 10 feet, and a small trunk, from which the natives compress an oil suitable for all kinds of domestic uses, and forming an article of internal commerce.

In the way of manufactures, the article made in the largest quantity seems to be pottery, usually in the shape of large water-jars or roof-tiles, the latter sometimes coloured. Local officials stated that these jars were shipped to all parts of the Yang-tse valley wherever boats could reach. Junks laden with them outward bound were seen in great numbers. Next to pottery; furniture, paper, and bricks seem to rank in importance as articles of manufacture.

The architecture of the houses and the details of all kinds of construction exhibit the same characteristics that are common to similar structures in other parts of the empire. The cities are walled, with double-gate towers of proportions formidable against anything but modern artillery. The streets and houses in the cities resemble those of other parts of Central China, while the farm-houses vary in their design according to the fertility and prosperity of the district. In the farming sections of the Siang and Lu valleys, artistically designed and substantially constructed buildings set within a compound bespeak good crops and a farmer of means. Along eastern Hu-nan, where the soil is poor and arable land scarce, the houses are built of half-burned bricks, with thatched roofs, the whole meagre and unkempt, indicating a hard struggle to maintain existence.

The bridges, as elsewhere in China, excite the admiration of the traveller, especially of one of scientific training. The smaller structures are composed of stone stringers, while the longer ones are arches, some of the latter being structures reflecting great credit upon the designers. At Li-ling there exists an extraordinary wooden cantilever, consisting of

WU-SHWEI GORGE ABOVE LO-CHANG.

six spans, with a total length of 480 feet and a width of 20 feet. This exceedingly interesting bridge, whose history I could not learn, has masonry piers with a superstructure of large timbers in layers, at right angles to each other, forming projecting arms over the piers until the span is narrowed to a width to be bridged by a timber stringer.

Irrigation works are found everywhere, provided the land is capable of raising rice. The commonest form is a pond or reservoir with an earth embankment, constructed at an elevation sufficient to allow the impounded waters to drain naturally over the fields. Diversion weirs of stone or concrete were found on the small streams, while on those rivers whose fall was insufficient to permit their waters to be diverted, undershot water-wheels with buckets to raise water are employed. This last device is mechanically very uneconomical, but as each wheel suffices to raise enough water to irrigate a rice-field, that is all the individual owner asks for.

It had been anticipated that the Cheling highway and pass of the same name marked the low level in the Nanling range, for even such accurate observers as Richthofen and Morrison had not questioned the prevalent belief. In their journeys, however, they were hurried through by the Chinese officials, and, moreover, were not engaged in making specific determinations. In the present inquiry such a matter was of the utmost importance to be determined accurately and beyond question. A very small amount of investigation sufficed to indicate that ground lower than the Cheling pass existed in the same neighbourhood, but the discovery of such ground was a matter of considerable difficulty, owing to a peculiar geological formation. By tracing on foot individual streams to their springs, the true pass was discovered to lie some 5 miles north-east of the Cheling, and that the so-called Cheling pass was only a false pass on the flank of a valley, and, instead of marking the divide of the Yang-tse and the China sea, it actually lay in the drainage area of the latter.

The Nanling range runs east and west. Just east of the Cheling highway there runs a sharply marked spur, both north and south, whose ridge was estimated to be at an elevation of 2000 feet above the surrounding country, with the peaks 1000 feet above the ridge. The northerly extension of this ridge separates the valley of the upper Lei from that of the Yu-tan, and its uninterrupted continuance we traced to the junction of the two streams. This ridge precludes the possibility of any other low pass through the Nanling, except the remote chance of one existing at the headwaters of the Lei. As the Chinese report no pass until the Meling in Kiang-si is reached, it is fair to presume that this statement is correct, and that there is no break in the main range between Cheling and Meling. South of the main range the above-mentioned ridge continues to Shao-chau, forming the divide between the waters of the upper Pei-ho and the Wu-shwei.

This ridge stands, therefore, like a great wall, along whose western foot flow the Yu-tan and Wu-shwei rivers, the waters of which are found even in dry seasons within half a mile of each other. On the west side of these streams the hills again rise, forming the flank of another but much smaller spur of the Nanling, on which flank the Cheling highway has been located going through a gap or false pass, and to which the name of Cheling pass has been given. The reason for this mistake on the part of the Chinese is due to the peculiar formation of the valley proper. The local rock is a soft and soluble limestone. Crossing the valley are five dykes of harder limestone that have resisted erosion. These cross-dykes occur in two pairs in a distance of 4¾ miles, with a single one about midway. The height of the northern pair is 90 feet, with an interval of 1500 feet. The wall of the north one of the northern pair is quite steep, coming to a sharp edge on top. The south one has a steep wall on the north side, but a more gradual ascent on the south. The tiny basin between them is cultivated at the bottom, and is only 10 feet higher than the ground immediately to the north of the north dyke. The divide of the waters between the Yang-tse and the China sea takes place immediately to the south of the south dyke, the Yu-tan flowing north and through the limestone rock of the two dykes themselves. The survey party, to commemorate the discovery, named the pass "Parsons gap." The Wu-shwei flows south from this point, gradually increasing in size. By the time the intermediate dyke is reached it is a permanent stream, and pierces the dyke by means of a natural tunnel; and, again, likewise flows through the southern pair of dykes, which latter resemble the northern ones, except that they are larger. Their height is about 150 feet, with an equal width on top, and an intervening distance of about 2000 feet. The Wu-shwei at this point is a well-defined small river, even in dry seasons, is at all times clearly in evidence at the bottom of the valley, and issues from the sides of the dykes with a strong and vigorous flow like a huge spring. To one standing at either the north or south end of this valley, the cross-dyke gives every appearance of a terminal divide, and there is nothing, except a personal examination, that leads one to suspect that the highway is not what it appears to be. The native maps place the divide between the Yang-tse and China sea at the southernmost dyke, near the village of Yao-tien, and are, of course, in error. The elevation of the divide of the watershed is about 120 feet lower than Cheling, or about 1080 feet above tide. Baron Richthofen gave the elevation of Cheling at about 1000 feet, and Mr. Morrison put it down as not exceeding 1200 feet, both of which observations were based on barometric readings, but our instrumental determinations confirmed Mr. Morrison's limiting figure.

The provincial boundary between Hu-nan and Kwang-tung lies

15 miles south of Cheling, and therefore not coincident with the drainage lines. The change from Hu-nan to Kwang-tung is at once noticed in the architecture of the houses, as the latter follow the more solid Cantonese type of construction. The singular Kwang-tung pawnshop, with its high and massive masonry tower, in which all goods are stored, supposedly safe from attack by fire or thieves, is also at once found.

Kwang-tung is freely open to foreign travel, and has been fully explored and accurately mapped, at least as far north from Canton as Shao-chau. The maps accompanying this paper give the details corrected for the Wu-shwei, which is the west branch of the Pei-ho after its dividing at Shao-chau. From the end of the Cheling highway at I-chang to Lo-chang, a distance by water of 44 miles, the river flows through a continuous gorge with a succession of rapids, the average fall of the stream being 8 feet per mile. Between Lo-chang and Shao-chau, 30 miles, the valley is much constricted, but the fall is less, being at the rate of 3·3 feet per mile.

North of Shao-chau the province of Kwang-tung possesses a very scant population. Along our route the only places beyond little hamlets of boatmen are Shao-chau, Lo-chang, Ping-shih, and I-chang. The first named is a city of some importance, containing probably 10,000 people. It is at the head of large junk navigation, *i.e.* available draught at low-water stage of 12 inches, and where all cargoes destined for the Cheling *viâ* the Wu-shwei, or the Meling *viâ* the Pei-ho are transhipped. Lo-chang owes its experience to the fact that it is the point where the rapids begin, and is therefore the limit of small junk navigation, for between Lo-chang and Shao-chau boats must draw less than 12 inches. At Lo-chang all cargoes are divided and loaded into small san-pan, drawing 3 or 4 inches at the maximum for transit between there and Ping-shih or I-chang, where they are unloaded finally for packing over the Cheling. Beyond being re-loading stations, these places have no other reason to exist. Lo-chang has a population of about 2500, and Ping-shih and I-chang about 1500 each.

The coalfield of Hu-nan extends southward to Shao-chau, but has never been seriously developed, owing to lack of demand, as Canton and vicinity can be more readily and cheaply supplied from West river points, Tonking, or even Japan. With proper transportation facilities, the coals of northern Kwang-tung will be developed. They are anthracite or semi-anthracite, samples obtained by me showing on analysis fixed carbon, 80 to 83 per cent.; volatile matter, 12 to 15 per cent.; and ash, 6 to 9 per cent. These coals were firmer than the average Hu-nan coal. South of Shao-chau the province of Kwang-tung is so well known that I can add but little that is new.

The population of Hu-nan, and for that matter the whole of China, has, I believe, been very much over-estimated. I travelled through the

most densely populated districts, and am convinced that the ordinarily stated figure of 20,000,000 for Hu-nan is too great by a half. Outside of Chang-sha and Siang-tan there are no great centres of population, while the country villages are very few and small as soon as one departs from the trade routes.

At the beginning of this paper mention was made of observations as to magnetic variation. At Hankau the variation was found to be about 40' W., and this variation to diminish gradually to Cheling, where the line of "No variation" was crossed, from which point it increased to the east to Canton, where it was determined to be 45' E.

The coalfields of Hu-nan have been described because they came under particular notice; but other minerals, such as iron, copper, antimony, lead, and silver, are believed to exist in paying quantities, but have never been developed. On account of its mineral wealth and location on the natural highway between Central and Southern China, Hu-nan is certain to be a great factor in the future commercial and industrial growth of China.

PROF. CVIJIĆ ON THE STRUCTURE OF THE BALKAN PENINSULA.

By Dr. KARL PEUCKER.

PROF. CVIJIĆ, to whom we are indebted for definite proof of the glaciation of the mountains of the Balkan peninsula during an ice period,* and for the solution of the problem of the great Macedonian lakes, has applied the great store of observational data at his disposal to the unravelling of the life-history of the region. The investigation, which was no doubt prompted in part by the problems suggested by Eduard Suess in 'Das Antlitz der Erde,' is of exceptional interest and value as a geographical study.†

The chief points to be elucidated are, (1) the structure of the ancient core of the peninsula, consisting chiefly of crystalline rocks; (2) the relation of the core to the mountains resting upon it, which are composed of more recent sedimentary formations; (3) the relations of those mountain systems to one another—a chapter of surprises; and (4) the relation of the internal tectonic conditions to the surface forms of mountain and coast-line.

Prof. Cvijić's researches can be directly connected with those of the following investigators: in the west, A. Boué, Viquesnel, A. Bittner, E. Tietze, K. Hassert; in the south, M. Neumayr, F. Teller, A. Philippson, Hilber; in the north-east, Ferdinand von Hochstetter and Franz Toula.

* J. Cvijić, 'Das Rilagebirge und seine ehemalige Vergletscherung, *Zeitschrift der Gesellschaft für Erdkunde*, Berlin, 1898, pp. 201-253. Also *Geographical Journal*, vol. xiii. pp. 427, 655.

† The first publication will be found in a series of short papers, maps, and sections appearing in the *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften*, Vienna, vol. cx. A complete account of all the observations and results will appear later in book form.

The ancient core of the Balkan peninsula is analogous to the *massifs* of the Scottish mountains in Great Britain, of the central plateau in France, and of Bohemia in Central Europe; it may be termed the "Rhodope" *massif*, from the name of its extensive mountain system (see map), and it includes, in the widest sense, the mountain regions of the central and southern part of the peninsula. It begins in the south of the Balkans, sends a branch north-westward through the middle of Servia to the border of the old Hungary-Croatian mass, which has almost disappeared, extends to the Ægean sea, and eastwards to the Black sea. The outline of the western boundary can be seen from the map; its trend is in general north and south. It is ill defined in parts, but in places longitudinal depressions like the lakes of Kastoria and Prespa, and, further north, the great Kosovo polje—the historic "Amselfeld"—make it perfectly clear. Depressions of this type are not, however, confined to the boundary between older and newer rocks; to the west, amongst the younger mountains, and again east of Lake Prespa, within the area of the ancient rocks, parallel lines of faulting and dislocation also run north and south. These include, in the west, the basins of Kortsha and Ohrid, separated from one another by a ridge of crystalline rock, and of Debar (of these the second is the largest and deepest; see *Geographical Journal*, 1900, No. 2, pp. 215-219); and in the east, the basins of Monastir (Bitolj) and Tetovo-Gostivar (Kalkandele). The discovery of *Schollen*, derived from fractures, has revealed the existence of similar depressions within the core, to the south of the Balkans; here also they run parallel to the fold of these mountains. While the strata of the younger mountains are in general only folded, fracture occurs near the boundary of the ancient rocks, along lines which correspond to the direction of folding. Within the Rhodope mass, the surface is not invariably formed of crystalline rock; beds of younger formation are common. The rocks of all ages are folded, but the newer (cretaceous) rocks lie unconformably on the older, notably around Skoplje (Üsküb). Only the most recent (neogene) deposits are unfolded, but these are often shattered into *Schollen* by fracture in such a way that neogene and crystalline rocks appear at the surface together; occasionally, at the margin of the basins, they stand vertically alongside. A region of this interesting type occurs in the north of Seres, Southern Macedonia.

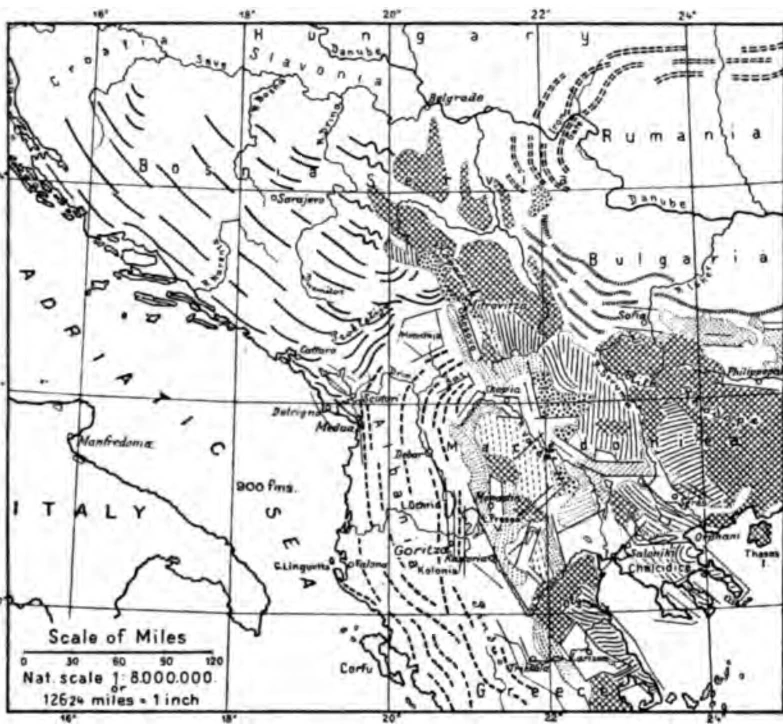
These two unconformities, between crystalline and cretaceous rocks on the one hand, and between palæogene and neogene on the other, suggest the occurrence of two distinct periods of severe folding, one after the formation of the crystalline schists, and one after the Cretaceous period; and it would seem that the second continued till middle Tertiary times, constituting the chief folding of the Rhodope *massif*. The *massif* is thus clearly distinguished from that of Bohemia, in which folding came to an end in the Carboniferous age.

After the folding, fracture and subsidence began, giving the mountain chains a direction independent of that of the lines of folding. From a long series of observations, Prof. Cvijić concludes that during the Quaternary period tectonic movements were practically absent in the north, while round the Ægean there was disturbance of exceptional intensity. The vertical displacement in the faults was often considerable: thus the Galičica rises 1300 meters (4300 feet) above the surface of Lake Ohrid, which is 286 meters (938 feet) deep, the Jakupica 2000 meters (6600 feet) above the bottom of the Skoplje basin, and the Schar-Gebirge about the same above the Kosovo Polje. But the greatest differences occur in the depressions in Southern Macedonia: the Gulf of Salonika is over 1000 meters (3000 feet) deep, and over it Olympus rises to 3000 meters (10,000 feet), and Mount Athos attains a similar height from still deeper sea. The intensity of vertical dislocation increases from north to south.

The dislocations, and with them the lake-basins, and also the beds of younger

rock, are entirely absent in the part of the Rhodope *massif* east of Vardar. This region is chiefly composed of granite, gneiss, and mica schist, with large quantities of recent eruptive rocks. It extends north-westward to the mountains of Southern Servia, such as the Kopaonik and others (see map). Its main axis forms the Rilagebirge, the highest (western) part of the Rhodope, the Pirin, and the mountains between Seres and Salonika; Cvijić terms this entire section of the ancient mass the "true core." The sections in Western Macedonia and south of the Balkans he characterizes as "transition zones;" they have certain features which distinguish them from both the Rhodope *massif* and the fold-

MAP SHOWING TECTONIC STRUCTURE OF THE CENTRAL AND WESTERN BALKAN PENINSULA.



Dinaric system
Græco-Albanian system
Balkan
Carpathian
Dislocations
Transition zones
Ancient massif
Recent eruptive rocks

mountains lying beyond them, and at the same time other features common to both. The resemblance is probably closer to the "true core," but there is also the correspondence of the lines of folding and fracture characteristic of the other area. It is noteworthy that the division into "true core" and "transition zone" denotes a difference more profound than that existing between the Rhodope and Bohemian *massif*.

Mention has already been made of the parallel dislocations in Western Macedonia. Their direction following that of the recent folds, is almost north and south

(S.S.E. to N.N.W.), the normal trend of the Græco-Albanian fold-system. The folding trends eastward in Central Greece only, but there are small deflections further north, in the folds which sink below the Adriatic at Cape Linguetta; these branch from the Pindus fold, which runs N.N.W., in the south-west of the Kolonia basin (see map). A "virgation" occurs here in the Albanian system, and the Acroceraunian group obtains a sort of secondary independence from the bend to a W.N.W. direction. But the normal trend does not correspond to that of the northern Dinaric fold, as has been assumed, nor do the systems coalesce; south-east of Scutari there is rather a bending of the Albanian beds to the north-east.

What relation do these bear to the folding of the Dinaric system? The normal Dinaric axis runs north-west to south-east, but there are frequent bends in the folding, even in the northern part (North-West Bosnia), to east and north-east, and this occurs more frequently the further south we go. The grouping of the normal and deflected folds is such that the successive bends may be said to form a series of overlaps; the conditions are markedly different from those met with in the Jura and the Appalachians, where the direction of folding is constant. The islands and peninsulas of the Dalmatian coast correspond to eastward folds, but the deflection increases towards the south-east. From Cettinje the folds, although not all in the same latitude, bend to the north-east; here again we have the succession of overlaps, especially in the coast mountains between Cattaro and Dulcigno. The same structure appears finally in the Rumija mountains between Dulcigno and Lake Scutari, where it forms a kind of tectonic centre. The eastward deflection is specially remarkable here, for low ranges, maintaining the normal direction of fold, extend as far as Medua. The bending to the east is, as it were, begun, but before it can be completed there is a sudden shift through a right angle to the north-and-south direction of the Albanian folds. At this important point there is a sharp boundary between the pure limestone of the Dinaric ranges and the "Flysch," rich in serpentine, of the Albanian. We shall return to the problem of those southern Dinaric ranges. The fold which bends north-east from the Rumija mountains continues beyond the southern end of the Scutari lake as the Rosaf mountain, on which is a Turkish fortress, but all the folds of the coast-ranges between Cattaro and Dulcigno are continued, with the break at the depression of the Scutari lake, in the ranges of the so-called North Albanian Alps, or Prokletije (see map). So far as is known, the strata forming the latter correspond to those of the Dinaric system, to which we may therefore conclude they actually belong. Although their topography is imperfectly known, it can be said that in length, height, and boldness of outline the Prokletije are the most remarkable members of the Dinaric system, and amongst the most noteworthy ranges of the peninsula. According to Kurt Hassert's estimates, which have been checked by Cvijić, several of the peaks of the Prokletije exceed Durmitor in Montenegro (2530 meters—8300 feet) in height. Durmitor has hitherto been accepted as the highest mountain of the Dinaric system, but it seems likely that some of the Prokletije rise to at least 3000 meters (10,000 feet). The Prokletije consist of several ranges, which together sweep round in a great bow, having the convex arc to the south-east. The general character of the ridges is similar to that of Durmitor, and of the mountains of Herzegovina on both sides of the Narenta. The outermost or south-eastern range is the highest; it rises steeply out of the great plain of the Metochija, and in no other part of the peninsula are greater differences of level to be found. The limestone walls extend right down to the level of the plain, and it occurs to one at once that here is a structure due to faulting, a supposition confirmed by the presence of thermal springs at Banja and Drsnik.

The Dinaric folds bend to north-east in the same way as the Albanian.

South-east of the Scutari lake the two run close together, the latter forming the southern foothills of the Prokletije, from which they are separated by the valley of the Kir, a stream flowing into the Drim near Scutari. Abundant limestone and dolomite are characteristic of the Dinaric system, while the "Flysch" zones are distinguished from those of the Albanian system by the complete absence of serpentine. South of the great Metochija subsidence the Albanian folds trend south-west to north-east in the Paštrik, Koritnik, and Schar ranges.

The folds of the Dinaric and Græco-Albanian systems form what Eduard Suess has termed a *Scharung*. The Dinaric folds bend more and more persistently to north-east as we go southward, ending in the ridge of the Prokletije, where the greatest elevation is attained, and meeting the Albanian folds before the latter have been fully deflected from north to north-east. In this *Scharung* lies a series of open basins, the origin of which is purely tectonic. Of these the tertiary basin of Metochija lies furthest to the north-east; in the centre, and much lower down, is the diluvial basin of Scutari; and the lowest depression in the bottom of the Adriatic must be counted as a third. According to the soundings made by the Italian and Austro-Hungarian Governments since 1867, the last-named lies in a line drawn from the Metochija basin to the inner angle of the coast, and runs steeply down to a depth of 1645 meters (5400 feet, or 900 fathoms). Cvijić names this deepest of the three basins, after the name of the bay, the Medua basin. The Albanian ranges attain their greatest heights in their north-easterly course south of the Metochija plain, and although, on account of certain peculiar tectonic features, Cvijić does not consider the proof that the Schar mountains belong to the Græco-Albanian system quite complete, it is nevertheless remarkable that their direction and general elevation suggest that they are the analogue of the Prokletije (Ljubotin summit stands at 2510 meters, or 8200 feet).

In any case, it may be said that the discovery of the *Scharung* structure between the Dinaric and Græco-Albanian folds solves the old geographical puzzle of the transverse position of the two great mountain systems on the frontier between Montenegro and Old Servia and Albania.

Returning now to the relations between the boundary of the younger folded systems and the two zones of the Rhodope *massif*, it is important to observe that the bend of the strata to east and north-east can be traced in a part of the transition zone of the ancient mass to the south of the Schar mountains and west of Skoplje (Üsküb), parallel with the longitudinal direction of the Tetovo-Gostivar depression, as already stated. But it is no less remarkable that in the north-east the Schar range, on attaining its greatest elevation, drops suddenly at a fault, and abuts on the crystalline rocks, the lines of folding running at right angles. This fault-line contact with the ancient *massif*, which has already been noticed in the southern part of West Macedonia (Kastoria-Prespa), continues northward beyond the Schar mountains as far as Novibazar, between Montenegro and Servia, north-east of the Prokletije. The subsidence along this line was accompanied by outbursts of eruptive material, which appears between the folded and older crystalline rocks. Still further north again, in Western Servia, the Dinaric folds abut against the crystalline mass at right angles, and it is interesting to note that the line of contact takes a zig-zag form. The "winding folds" disclosed here constitute a new tectonic form, which has not been observed elsewhere (see map). On the other side, north-east and north of the Rhodope *massif*, the folds of the younger mountains run, in general, parallel to the line of contact. Within the folds themselves, however, occur structures similar to those between the two recent systems in the west. They do not, as has been assumed, form a single system, but belong to two, the Carpathian and the Balkan. The outer fold-lines of the former, coming from the

north, bend east and south-east to the south of the Iron Gates, and disappear beneath the unfolded Sarmatic schists of the Bulgarian plateau. The folds of the Western Balkans, like the master-fold of the Central Balkans discovered by Toula, constitute a separate system.

This sketch of the general tectonic conditions was essential to a clear understanding of the relations between outer and inner structures of the Balkan peninsula, of which we may now indicate the main lines, as laid down by Cvijić. Tectonic agencies are supreme in determining the terrain within the Rhodope *massif*, *i.e.* in the central and south-eastern parts of the peninsula. The original folds have been broken through by the dislocations referred to above, either diagonally or at right angles to longitudinal axes, so that the geological and orographical lines rarely correspond. The fractures and subsidence of *Schollen* have completely altered the direction and grouping of the mountains which existed before the vertical dislocation occurred, and in their place we have wide undulations and plateaus of rounded uniform outline, 20 to 30 kilometers in width, quite distinct from the younger folded mountains with their narrow ridges. Still more characteristic are the depressions, which are a direct result of the dislocations; these have cut deep basins which afford a strong contrast to the form of surface just described. Some of these basins cover 1000 square kilometers (400 square miles), and the fundamental difference between the terrain of the *massif* and the region of younger rocks is their relatively large number. Many of them were deep lakes at the beginning of tertiary (neogene) times, and were subsequently dried up, partly because of the lowering of the outlets, partly on account of climatic changes. These dried-up neogene lakes are the European analogue of the great diluvial lakes of North America discovered by C. K. Gilbert. In America, as in Europe, nearly all lakes date from the end of the glacial period, and Cvijić's discovery of lakes of much greater age is of extreme interest. The survivors are the Ohrid lake, the two Prespa lakes (of which preliminary bathymetrical charts were reproduced in the *Journal*, 1900, No. 2, p. 216), and the Kastoria lake. In these lakes the formation of deposits is still going on, and the fauna still lives which the deposits in the dried-up basins show to have inhabited them for untold thousands of years. A transitional phase between the present lakes and the dried-up basins appears in several regions. In the place of the great neogene lake of Seres, for example, there remain three shallow pools. As we have seen, the southern basins are more recent; the lakes in the neighbourhood of Salonika are post-tertiary or diluvial; so is the Ostrovo lake, which lies between them and the Prespa lakes (see map). Along with three smaller lakes, these form the remains of one extensive lake of diluvial age. It appears, therefore, that the large number of lake-basins in the Rhodope region, and especially in Macedonia, are the result of tectonic displacements.

Amongst the mountains of the Dinaric system it is noticeable that the deflection in the direction of the *Scharung* seems to influence the formation of the large plateaux near Sarajevo and south-east of it by unusual disturbance of the neogene beds and other evidences of recent displacement. In the "Karst-poljen" the post-tertiary or diluvial terraces are always 15 to 20 meters lower in the south-west than in the south-east and north-west. The streams usually run south-west, and most of the gorges are on the south-western slopes. In these morphological features Cvijić recognizes the action of sinking of the Dinaric system by a series of steps to the Adriatic. In a paper on the Adriatic during the glacial period, under the title "L'époque glaciaire dans la peninsule des Balkans" (*Annales de Géographie*, ix. pp. 359–372, Paris, 1900), he has shown that only the northern, shallow part of the Adriatic basin can be of recent origin, the deeper southern part being older than the glacial period. Suess ('Antlitz der Erde,' vol. iii. p. 420)

has traced the actual coast-line of the older basin; it extends from the long Dalmatian peninsula of Sabbioncello across the present Adriatic to the small islands of Pelagosa and Tremiti and the east coast of Italy (see map). But the morphological conditions still further to the south-east appear to be the result of recent subsidences, and Cvijić regards the *Scharung* region inland from the Bay of Medua as the seat of greatest intensity of this subsidence. In consequence of it, all the valleys have become lakes, there are no signs of river erosion and no affluent streams; the slope surfaces have geometrical forms, bounded by straight lines along the ridges and between the foot of the slopes and the plains, as, for example, in the Mal Rencit and Kakaricit, north-west of Medua. Again, the subsidence has raised the level of the ground water, lessening the difference between it and the water parting; the drainage water has little erosive power, the slopes are not dissected, and neither valleys nor subterranean channels, like those of the Karst region, are formed. The fissures in the limestone afford the only escape for the surface water, and along these fissures the erosive action is intense; hence the modelling of the Sieb mountains. These ranges, which belong to the most southerly of the normal folds, called by Cvijić the "resistent Dinaric folds," are the type of intensely "verkarstete" mountains, the action being even more highly developed here than in the Karst plateaux above Fiume and Trieste, or in Lower Herzegovina. Every bed or surface of limestone is perforated and decomposed as if strong acid had been poured over it instead of rain-water. In some places the process of solution has gone so far that the more resistent masses stand out as monoliths, some as much as 8 meters (26 feet) high, giving the appearance of a plateau strewn with monuments and ruins.

But the existence and character of the Scutari lake is the strongest evidence of the subsiding movement, as has already been pointed out in the current volume of the *Journal* (No. 2, pp. 211, 212).* From the absence of fresh-water deposits, and other facts, Cvijič concludes that the Scutari lake came into existence in late glacial times. Both the deep clefts in the lake bottom at the south-western corner, and the small pointed inlets, are the result of subsidence. Valleys have been drowned out by the rising of the ground water. In the lower parts of the plain the ground water often covers detached areas of several square kilometers extent, and in winter all the low-lying ground is submerged. The slight fall of such rivers as the Bojana, the Drim, and the Kir causes them to overflow their banks, and large tracts of country are flooded. The whole region, in fact, frequently becomes a bay of the Adriatic and the "resistent" ridges veritable *Scoglien*. The amount of the material deposited by the *Scharung* rivers is then enormous, the Drim and the Kir affording some of the most striking examples of river transport in Europe, as has been described by Boué and Hahn. The Kir at one time flowed into the Scutari lake, now it joins the Drim at a point considerably to the south.

Tectonic agencies have also exercised a profound influence on the outline of the Balkan peninsula, more especially the Dinaric-Albanian *Scharung*. On account of the sharp bend in the folds in the interior, the coast-line shows an opening in the form of a bay, the bay of Medua. On the south-east, the gulfs of Salonika and Orphani correspond to this, except that they cut much closer into the peninsula. The researches of the Austrian geologists F. Teller and M. Neumayr have clearly shown the gulf of Salonika to be due to subsidence, and the three-pointed inlet of Chalcidice to faulting. Cvijić has now assigned the bay of Orphani to faulting, and

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* A preliminary bathymetrical chart of the Scutari lake, from Cvijić's soundings, appears in *La Géographie*, 1902, pp. 259–260. The scale is 1 : 200,000, not, as stated. 1 : 150,000, which was the scale of the original before reduction.

this whole system of fractures, and with it the form of the coast of the northern Ægean, has been brought into relation with the southward-increasing subsidence within the Rhodope *massif*. The angle of the bay of Medua and the subsidence on each side of Chalcidice have their origin alike in the interior, and the broad openings extend from the *Scharung* basins described above and the "Amselfeld" or basin of Kosovo to the gulfs of Medua and Salonika, right through the heart of the peninsula. The increase southward of the vertical dislocations in the ancient core has led to the Balkan peninsula having its least breadth from north to south, and has opened a natural highway—the line from Belgrade to Salonika. The varied tectonic phenomena of the *Scharung* have given the west coast the nearest and most convenient harbours for the central districts.

Two different types of coast meet in the bay of Medua—the Albanian from the bay of Valona, and the Dinaric or Dalmatian type from the north. The rocky Dalmatian coasts consist of pure chalk and old Tertiary limestones, the Albanian of "Flysch" rock and weak neogene strata. The outlines of the former depend solely on the rock structure, according to the level to which subsidence has taken place; and since the limestone is dissolved chemically rather than weathered, there is little *débris*. The Dalmatian coast is accordingly of very simple type; being longitudinal, its features run in lines. Long stretches are practically straight, and the subsidence and submergence of valleys accounts not only for the systematic arrangement of the component parts, but for their extraordinary parallelism, as in the islands, peninsulas, and straits. The action of waves develops only minor forms, coves and creeks, caverns and natural bridges, or narrow channels 100 meters or less in length, like those in the island of Lacroma; minor forms which, nevertheless, give to these bare rocky shores a charm which is wanting on the Albanian coasts. The Albanian coasts follow the normal direction of the strata—north and south, and in contrast to the Dalmatian coasts, they often present wide flat stretches formed of river deposit. Between these cones of submerged deposit the coast retreats in open bays, and when islands are wanting, their place is taken by *Nehrungen*, dunes, and other tokens of a shallow water-coast. Inshore rises the steep coast of the ancient Adriatic of Tertiary time which has risen high above sea-level, like the coast of the Ægean, and in contrast to the Dalmatian coast. Cvijić points out that the effect of these variations in the changes in level, here elevation, there subsidence, has not been lost sight of as a factor in the formation of the *Scharung* basin of Medua itself.

The tectonic sketch-map of the central and western parts of the Balkan peninsula has been prepared by the author from the large scale-maps and from the private data of Prof. Cvijić.

ADMIRALTY SURVEYS DURING THE YEAR 1901.

Under the orders of the Lords Commissioners of the Admiralty, seven of His Majesty's vessels, with three small hired steam-vessels, manned by 64 officers and 622 men, have been employed on hydrographical surveys on the home and foreign stations.

The following is a brief summary of the work accomplished, as detailed in the report prepared for presentation to Parliament:—

Reports of 315 rocks and shoals, which were dangerous to navigation, have been received at the Hydrographic Department, and were notified to the public by notices to mariners; 1360 miles of coast have been charted, and an area of 7851 miles has been sounded.

In Great Britain, various resurveys of parts of Portsmouth and Plymouth harbours were made. Parts of the coast of Yorkshire were resounded. Areas in the Thames estuary were re-examined; and the river Stour was resurveyed.

St. Helier in Jersey was surveyed, and other amendments made to charts of the Channel islands. Detailed observations on the tidal streams among these islands were also carried on for several months.

The upper portion of the Bristol channel was resurveyed, and much change found.

Kyle Rhea, Kyle Akin, and Raasay sound were recharted, several new rocks in the passages being discovered.

In Newfoundland, the survey of some of the intricate bays in Notre Dame bay was accomplished, and part of the harbour of Sydney in Cape Breton island was surveyed.

In the Red sea, a survey of the strait of Bab-el-Mandeb and its approaches was finished.

In the China seas, two ships were at work. The waters round Labuan were surveyed. Two surveys were made in the vicinity of Hong Kong. Part of the shores of the British sphere of interest in Shantung promontory was recharted; and various searches made for reported dangers in the China sea. One of these resulted in the verification of a very dangerous small reef in the centre of the approach to the Yellow sea, lying 80 miles from the nearest land, and which had been touched by the P. and O. steamer *Socotra* in the night in 1900.

In Australasia, the survey of the inner route on the Queensland coast was continued, and various dangers found, others disproved.

Surveys of the Bay of Plenty, in New Zealand, Tauranga and Coromandel harbour, and other places were made.

In British Columbia, the survey of Johnstone and Broughton strait, and of the strait south of Active pass was completed.

The survey carried on by the Indian Government charted the coast between Cuddalore and Point Calimere, the Pamban pass, and Salaya harbour in Kutch.

During 1901, the Hydrographic Department has published 106 new charts and plans, and 28 new plans have been added to existing plates.

The number of charts printed to meet demands has, during the year, amounted to 538,973.

REVIEWS.

ASIA.

Russian Turkestan.*

The literature of Central Asia is growing by leaps and bounds, unfolding new scenes, unearthing new treasures, and ever deepening the curiosity of Western readers. The student of the subject has reason to congratulate himself heartily upon the latest addition, M. Krafft's magnificent photographic representation of Oriental life. The reviewer has a difficult task before him—the necessity of praising without reserve. As to the scope of the book, few words suffice; the rest must be seen. How can the critic speak when the artist eloquently preaches? The author has traversed Russian Turkestan from Marghelan to Bokhara, touching the important centres

* Hugues Krafft, 'A Travers le Turkestan Russe.' VII. and 228 pp., 265 photos and 1 map. Paris: Hachette. 1902.

of Kokan, Tashkend, and Samarkand. The text is a well-written, simple, and straightforward account of the country; it can be recommended as a most reliable introduction to the study of the region, and a perfectly safe guide to future visitors. The descriptions are correct, showing careful observation and sound judgment. In separate chapters we find comprehensive surveys of "Modern Russian Towns," "Ancient Native Cities," "The Great Monuments of Samarkand," "Country and Landscape," "Dwellings and Customs," "Types and Costume," "Great Mussulman Festivities." Here and there the author has added to and improved the information given by previous travellers. The appendix contains data on statistics, administration, history, trade, industry, archæology, etc., and the map is made more useful by references to historical geography, the names in question being printed in red.

Thus, on the text one cannot pass any criticism. What the author wished to say he has said well, leaving no room for adverse comment. He does not pretend to offer the results of original research, nor could we fairly ask for such, seeing that all his attention must needs have been focused on the working of his camera. The letterpress is a running commentary worthy of the pictorial and artistic part, and of this latter one can hardly speak with too much enthusiasm. I have wandered through the crowded streets of Bokhara city, and my eyes have dwelt often on the stately mosques of Samarkand. M. Krafft reproduces these scenes for me as none have done before. I recognize the old haunts and the familiar faces of the bazaar; there is the fruit-stand at the corner, the old curio-dealer, true to nature with every wrinkle of his features; and there is the boy who used to sell cakes in our neighbourhood. They all come back and speak. The fine tracery on the crumbling walls of Shah Sindeh tells its melancholy tale of beauty doomed to perish from neglect. When the artist touches the chord, memory responds.

Here we find the combination of technical skill and æsthetic perception to which Sella has accustomed us in other subjects. It is quite impossible to select for special mention a few out of the 265 photographs. The best cannot be found; it would be futile and invidious to search for the inferior. The greater number represent the people and their life; next in importance are architectural studies. Among the landscapes is a peep of the high mountains from the village of Urgut, which seems to have been the most outlying station touched by the author. The portraits are splendid, and afford first-class material for the study of the racial types of Uzbeks, Saits, and Tajiks. Dwellings, dress, and occupations are depicted with exhaustive thoroughness, and we are instructed in every detail of the day's work or pleasure. Many are the rare views, so difficult to obtain, of religious ceremonies, of crowds and festivities, or of the demi-monde of Samarkand. The series on the game of the goat at Afrasiab is very fine indeed. Thus one might go on praising indefinitely, but I hope I have said enough to tempt the most sceptical reader of reviews.

The day may come when the brilliant hues on the khalat of the Bokhariot merchant shall yield to European uniformity of costume, or when the courtesan of the Baikabak will wear last year's spring fashions from Paris. Then the full importance, the immense value, of M. Krafft's beautiful book will be appreciated with tenfold intensity by those who came too late to have seen the days of old, and by those who can still recall them to memory. Their regret for the glories of the past will find consolation in a tender and sincere gratitude to him who saw these things and knew how to perpetuate them.

W. R. Rickmers.

AFRICA.

EARLY TRAVEL IN ANGOLA.*

The importance of Mr. Ravenstein's volume to the student of historical geography is not to be measured by its size alone. The text of the narrative of sixteenth-century travel, therein reprinted from 'Purchas his Pilgrimes,' occupies in it no more than seventy pages, while with the introduction, appendices, and the excellent index and glossary, it does not extend to two hundred and fifty; yet it may safely be said that few of the hundred odd volumes so far issued by the Hakluyt Society possess a greater original value as contributions to the history of geographical discovery. The editor has done his part in a way which makes the book a model of what such a work should be; and, though many of the early narratives made accessible by the useful work of the Hakluyt Society surpass in intrinsic interest the simple story of the adventures of Andrew Battell, this is more than made up for by the careful and thorough elucidation, not only of the many obscurities of the text, but of the whole history of early European intercourse with Angola which Mr. Ravenstein supplies. In collecting material for the maps and notes, he was at the pains to consult all available literary sources of information on the history and geography of Kongo and Angola, from the old writers like Lopez and Cavazzi to the modern works of Baptist missionaries and others; and it was a happy idea to present the general results of his researches in appendices, describing the history of those countries from their discovery to the end of the seventeenth century, which form perhaps the most valuable part of the volume. The map by which the history is illustrated has been compiled with much care, amid difficulties arising from the surprising absence of detailed information on many districts even at the present day. In spite of these, Mr. Ravenstein has succeeded in tracing the probable routes, not only of Andrew Battell, but of the various Portuguese expeditions, Roman Catholic missionaries and others, including that laid down by Dapper in his map as leading to "Ocondi" on a southern branch of the Congo, which modern exploration enables us to identify satisfactorily with Nkundi on the Kwango. One result is to prove once more the baselessness of the idea that the Portuguese of those days possessed a knowledge of the remote interior, and to justify the absence of detail on the central region on such maps as that of D'Anville in 1732.

AMERICA.

THE FRENCH IN CANADA.†

This work is the outcome of much painstaking research, and may be considered as a serious contribution to our knowledge of the first beginnings of Canadian settlement and trade. Originally presented as a thesis for the degree of Bachelor of Letters at Oxford, it has since been considerably extended so as to form a compact and at the same time complete summary of our knowledge of the inception and execution of the various undertakings of the sixteenth and early seventeenth centuries, by which the way was paved for the ultimate entry of Canada into the family of nations. The outlines of the story have often been told before, both in the works and biographies of the actors themselves, such as Champlain, and in the more general narratives of modern writers, like Parkman, Harrisse, and

* 'The Strange Adventures of Andrew Battell of Leigh in Angola and the Adjoining Regions.' Edited by E. G. Ravenstein. London: Hakluyt Society. 1901.

† 'The Early Trading Companies of New France.' By H. P. Biggar, B.A., B.LITT. (Oxon.). University of Toronto Library. 1901.

Winsor, and it was not to be expected that anything decidedly new would be brought forward by the author; but in matters of detail, especially as regards the negotiations and proceedings by which the formation and organization of the great trading companies was brought about in Europe, Mr. Biggar supplies some new and valuable material. Not content with a perusal of published authorities, old and new, voluminous as these are, he has himself searched among unpublished records both in this country and on the continent, and has besides enjoyed the co-operation of various French workers in the same field. The results of the study are given in a readable form, and their value is increased by the exhaustive references to the original authorities, which will enable serious students to extend the investigation on their own account, if so disposed. The second half of the book, consisting of a critical examination of the sources, is fully equal in importance to the narrative portion. Mr. Biggar makes no claim to have finally settled the many questions on which fuller knowledge has been a desideratum. He has thrown no new light, *e.g.*, on the disputed question of the faith in which Champlain was brought up, or on the obscurity which attaches to Sagard's early career. But his work marks a step in advance, and should be a decided help to any who may be disposed to dive further into the fascinating story of pioneer effort in the New World.

The Norsemen in America.*

This interesting and valuable study treats the subject under five main divisions, of which the first (pp. 1–10) is given to the oldest (eleventh and twelfth century) accounts of the Norse discoveries in America; the second (pp. 10–19) to the later (thirteenth and fourteenth century) traditions of the same; the third (pp. 19–40) to the Norse colony in Greenland; the fourth (pp. 40–57) to the closing records of Scandinavian settlement in the far North-west; and the fifth (pp. 57–112) to the Cartographical Representation of Greenland in the fifteenth and sixteenth centuries, especially by Claudius Clavus, Nicholas (Nikolaus') Germanus, and Martin Waldseemüller. Father Fischer's work is illustrated by ten maps, the first six of which are taken from various works of Nicholas Germanus, and two others from Waldseemüller. Herein geographical students may find an excellent summary of the whole subject of the Greenland, Vinland, and other American voyages and settlements of the Northmen, largely based upon Storm and Reeves, but taking account also of other investigations, and discussing the whole with considerable originality and suggestive power. The cartographical dissertation is especially valuable, and represents the greater part of the author's own contribution to scholarship in this volume, especially in relation to the strange perversion of many fifteenth and sixteenth century maps (*e.g.* one of Nicholas Germanus of *c.* A.D. 1483), which placed Greenland, as a European peninsula, immediately north of Scandinavia, and east of Iceland. Very interesting and reasonable is the picture Father Fischer attempts to draw (in Part III.) of the Norse settlements in Greenland, their population, occupations, food, and buildings, as well as of their attempts to extend their knowledge and civilization to the north, west, and east. Every scrap of evidence is carefully used, from kitchen-middens to Runic inscriptions; and the well-known settlement of 1135 on Kingiktorsoak island in Baffin's Bay, on one side, is balanced by the equally striking record of the discovery of Svalbaldr (Jan Mayen ?) to the east of Greenland, in 1194. Among the other notable features of the present work is the full reprint and discussion of the letter of Pope Alexander VI., in 1492–93

* 'Die Entdeckungen der Normannen in Amerika.' Von Jos. Fischer, S.J., in Breisgau. 1902.

(lately discovered by Jelič), which gives us our latest-known information of the old Greenland colonies. But, as already noticed, the main feature of Father Fischer's study is his treatment of the map-portraiture of the north, and especially of Greenland in the cartography of Clavus, Nicholas Germanus, and Waldseemüller; in the course of this, Storm, Ruge, and Wieser (and especially the *Claudius Clavus* of the first-named) are vigorously supported in their criticisms of Nordenskjöld. There is, unhappily, no index, but an excellent list of "authorities" and "books consulted" is prefixed to the text (pp. ix.–xii.), and an appendix of documents relating to Nicholas Germanus is added (pp. 113–126).

C. R. B.

PHYSICAL GEOGRAPHY.

The Sea-Coast.*

The author deals first with the action of shore-waves and with littoral drift, in which he explains his notion of the wave of flood-tide, acting by means of small constituent undulations, which form breakers; and then passes on to a general description of the structure of sea-walls, as to which he speaks with authority, as an engineer of experience. Chapter V. gives instructive details with numerous figures of the sea-walls at Hove, Scarborough, Westgate, Bognor, Clacton, Southend, Bridlington, Blackpool, Dymchurch, Herne Bay, Felixstowe, Morecambe Bay, and of some of the sea-defences in Belgium and Holland, including the great Helder dyke. Chapter VI. deals with groynes, as to the form and structure of which there exists even more difference of opinion than on the subject of sea-walls. Under this heading a description is given of the ingenious system of groyning adopted by the late Mr. Case. The popularity of the Case groynes has undergone no diminution since the lamented death of their ingenious inventor. There is, however, some danger lest his principles should become a mere rule of thumb in the hands of less original men, and thus lead to applications which their inventor would probably not have sanctioned. Mr. Wheeler does not himself, in the work before us, advocate any special system of groyning or coast-protection, but strives to afford such information as to the varying geological and tidal conditions attaching to sea-coasts, and the result of protective works carried out under different degrees of exposure, as may be of service to those having charge of protective works, or interested in the destruction and preservation of land bordering on the sea. Chapter VII., which is more than half the book, contains in upwards of 200 pages a detailed description of the south, east, and west coasts of England, and this is the portion of the work which will chiefly interest English geographers. The concluding chapter deals shortly with the coasts of the North of France, Belgium, and Holland. As the work of a practical engineer of considerable experience of sea-defence work, and personally acquainted with a large extent of coast-line, this book will doubtless be read by many persons concerned, whether practically or as students, with the conflict between sea and land.

COMMERCIAL GEOGRAPHY.

"Commercial geography," says the author of the work under review,† "treats of the many influences operating all over the world which promote or retard the

* 'The Sea-Coast.' (1) Destruction; (2) Littoral Drift; (3) Protection. By W. H. Wheeler, M. INST.C.E. With Illustrations. Longmans. 1902.

† 'A Text-book of Commercial Geography.' By Cyrus C. Adams, B.A., F.A.G.S, London: Hirschfeld Brothers. 1902.

production, transportation, or exchange of the commodities, natural or manufactured, which man consumes or utilizes." The scope of the subject could hardly be better expressed, and it is no objection to this statement of its scope that it leaves room for different modes of treatment in accordance with different points of view. It must be recognized that changes are constantly going on in the nature of the influences referred to, and it might be thought by some that the most instructive and profitable method of studying the subject would be to devote a large amount of attention to the mode in which those influences have operated in the past, by others that the main consideration should be to endeavour to form an estimate of the influences most likely to affect the course of trade in the near future, and by others, again, that our main concern is with the present. Inevitably all these points of view are more or less adopted in any work on commercial geography. In this, as in most other works on the subject, it is the last that predominates, though here and there are to be found in it some very pregnant remarks as to the probable effect of changes now going on or for which the way is being prepared. Even when the main standpoint has been determined, difference of treatment must result from the consideration of the public for whom the work is primarily intended; and, though the present work bears on the title-page only an English imprint, and there is no express statement that an American public has been mainly kept in view, a very cursory examination shows that that is the case. The volume is one of the Twentieth Century Text-books, edited by A. F. Nightingale, Superintendent of High Schools, Chicago. For the public for which it is designed, the book seems to be well proportioned. At the first glance it might appear that an undue proportion was devoted to the United States, which have 132 out of 476 pages allotted to them, 48 of these 476 pages containing matter of a general kind; but on examination one finds that the 132 pages referred to are not really all concerned with the United States, the author having added under that general heading general notes with regard to the production of and trade in the most important commodities throughout the world. The matter is instructive in the best sense, appealing to the intelligence of the reader. In the words of the preface, "the facts of commerce are treated as the effect of conditions that determine the quality and quantity of trade." In most points the information appears to be accurate and up to date. The illustrations are numerous and apt, quite as instructive as the text. The great majority are maps, some of which are coloured. Some, it is true, are on too small a scale, and are overloaded. Not much, for example, can be said to be conveyed to the mind by the mineral maps on pp. 12 and 13, which compare very unfavourably with those on pp. 123–125 showing the situation of the principal deposits of iron ore in the United States. These in themselves speak volumes, and should, with the accompanying text, be examined by every one who wishes to understand the present situation of the iron and steel industry of the world. In such a work as this, it is of course practically impossible to avoid errors here and there. The map of the British coalfields on p. 206 is in several important points inaccurate, both in the way of excess and defect. The figures given for British imports from different countries on p. 213 are not, as stated, those of the "special" trade, but are general imports. In fact, the figures relating to the special trade are not procurable. On p. 221 undue prominence is given to the iron ores of the Harz with reference to the iron industry of the Ruhr basin, and there is no reference to the nearer and much more important deposits of iron ore about the headwaters of the Sieg and Lahn. The spelling Pimlico instead of Pamlico sound (p. 25) is a blunder that would have seemed more natural on this than on the other side of the Atlantic. It would be well to state (p. 130) expressly that the iron-yielding little island in Newfoundland, known as Bell Isle

(or Bell island, whichever be the correct form), is that in Conception bay, so that it may not be confounded with Belle Isle in the straits of the same name. It is a pity that English and American geographers cannot agree at least as to the spelling of the river Hwang-ho. The spelling Hoang-ho adopted in this book is suitable enough for the Portuguese and French languages, from which we adopted it, these having no better means of representing the sound of *w*, but in English it is quite misleading. The last point that we have to notice is a serious one, though it belongs less to geography than to economics, which indeed cannot be ignored in commercial geography. On p. 164 it is stated that "those nations thrive best in trade whose foreign commerce includes a large proportion of manufactures." One cannot but ask, with reference to this statement, what is to be the test of thriving? Has New South Wales not thriven? But when the author goes on to add, "the percentage of profit on manufactures is much larger than on foodstuffs and the raw materials of which goods are made," one is compelled to reply that that is in glaring contradiction with facts. One can only say with truth that in some cases the percentage of profits on manufactures is greater than that on raw materials, etc. But the proposition thus altered to meet the requirements of truth loses all its significance. We trust, therefore, that in the next edition of this work this statement will be not modified, but entirely suppressed. As it stands, it can only serve to lead students seriously astray.

GEO. G. CHISHOLM.

GENERAL.

TOSCANELLI'S MAP.*

The essential point of this elaborate and scholarly, if not always convincing, inquiry is defined by the author (p. 251) as follows: Everything goes to show that the map and letter of Paolo Toscanelli, addressed in 1474 to Fernam Martins, Canon of Lisbon and Privy Councillor of King Affonso V., as well as the copy of these two documents addressed to Columbus, and the undated letter (of similar content but slightly different wording) from the same to the same, are apocryphal, and were fabricated with a definite purpose. This purpose was to suggest to men's minds that Columbus's scientific theories, submitted to, and sanctioned by, a great astronomer, led to the discovery of 1492. Further, Bartholomew Columbus, 'a good cosmographer but a bad Latinist,' was probably the author of the fraud, Christopher being either entirely innocent of the whole thing, or showing himself at an early date (probably before 1494) unwilling to have more to do with the 'machination.' The great discoverer's cosmographical ideas were indeed similar (it is admitted) to those we find in the Toscanelli correspondence; but they were his own, and not derived from the Florentine astronomer; they were elaborated *subsequently* to the discovery of 1492, and what they owed to the books or the thoughts of others was principally through Columbus's reading of the 'Imago Mundi' of Cardinal Peter d'Ailly. Lastly, the story of the nameless pilot who discovered the Antilles by chance, or believed himself to have discovered them, is firmly maintained as true and essential by M. Vignaud, who considers that the suggestions communicated to Columbus by this pilot were the determining cause of his enterprise and its success. At the time of his discovery (1492), according to this view, Columbus had no cosmographical theory, no map with the *imprimatur* of Italian science, but only a chart on which he had indicated, in

* 'La Lettre et la Carte de Toscanelli; étude critique. . . . par H. Vignaud.' Paris: Leroux, 1901. (Recueil de Voyage et de Documents pour servir a l'histoire de la Géographie, XIII^{e}.-XVI^{e}. siècles.)

conformity with the ideas of his pilot friend, the position of the islands where the pilot believed himself to have been.

M. Vignaud himself admits that his criticisms are in great part hypothetical; and further, that they are encumbered with certain positive difficulties. If we are in the presence of apocryphal documents, we should be able to find a proper explanation of the forgery, whereas we have only conjectures which, however plausible, are by no means proved, and whose probability cannot be admitted without reserves. The suggestion of Bartholomew Columbus's fraud is quite gratuitous, resting only on his skill in cosmography, his weakness in Latin, and his devotion to his brother The letter of Duke Hercules of Este in 1494 is another stumbling-block. For in this year a great European personage seems to have full knowledge of a past exchange of ideas between Toscanelli and Columbus. Again, the apparent denial of 'any' cosmographical theory to Columbus in the venture of 1492, may be met by the terms of the argument itself, where he is credited with a theory adapted from the un-named pilot; and the view that the Portuguese, before 1474, never sought for the Indies at all, except the India of Prester John, hardly seems to bear in mind various definite passages and indications in thirteenth, fourteenth, and fifteenth century literature and cartography which point to another conclusion.

C. R. B.

THE MONTHLY RECORD.

EUROPE.

The "Landes" of Gascony.—An instructive sketch of the physical conditions prevailing in the district of south-west France known as the "Landes" is given by Dr. Engell, of Copenhagen, in the February number of *Petermanns Mitteilungen*. The writer begins by tracing the geological history of France since early Tertiary times, showing that the "Landes" form one of the most recent areas in the country. He next contrasts the conditions prevailing in this area with those of the rest of France, dividing the country into nine natural provinces on the basis of climate and vegetation, the "Landes" forming a subdivision of the south-western province. Dr. Engell hopes to develop his views as regards these natural provinces—the limits of which he has for the first time endeavoured to lay down approximately—in a subsequent article. Coming to the special subject of the paper, he describes in turn the iron-bound coast-line with its belt of dunes, the heath-lands further inland with their types of vegetation, the scanty animal-life, and the industrial conditions of the district. Among the most interesting points is the extent to which the aspect of the country has been modified by human agency, the once bare and glaring sand of the dunes having given place to a complete covering of *Pinus maritimus*, while in the heath-lands also the extensive planting of trees has interfered with the natural struggle for the mastery between heath and forest, to the advantage of the latter. In the "Landes" proper, population is naturally scanty and scattered, even Arcachon owing its existence to factors not properly connected with the geographical conditions of the district as a whole. The industrial life of the district depends almost entirely on the products of the forests—turpentine, charcoal, timber, etc.—especially the first-named, which is of noted quality, and of which the production is the *raison d'être* of the few factories which the "Landes" possess. It is for the transport of such forest products that the fairly extensive railway system has come into existence.

The Highest Point of Sardinia.—It appears from a note by Attilio Mori in the *Rivista Geografica Italiana* for February last that the uncertainty which has hitherto existed as to the highest point of Sardinia has been removed by surveys carried out in 1900. The value fixed in 1834 by La Marmora, by barometric observations, for the Punta di Bruncu Spina on Mount Gennargentu was for long accepted as giving the altitude of the culminating point of the island. This value (1918 m., or 6293 feet) was found by Prof. Lovisato, who carried out careful measurements with a Fortin barometer in 1892–95, to be too high, and his observations were confirmed soon afterwards by the triangulation of the Geographical Institute, which fixed the height of the Bruncu Spina at 1828·56 m., or 5999 feet. In 1895, however, Prof. Lovisato obtained data which seemed to show that other points of the group slightly exceeded the Bruncu Spina in height, and this has been in part confirmed by recent topographical surveys, which have shown that a point named Perdu Crapias, in the same group, reaches a height of 6017 feet, and is therefore the culminating point of the island, to which it is proposed to give the name Punta La Marmora.

Rivers and Forests in Russia.—In the April number of *La Géographie*, M. Flahault sums up the results of recent research on the interrelation of rivers and forests in Russia, a failure to allow for which has, he says, already seriously affected the *régime* of the rivers, though a movement is now on foot for remedying the evil affected, so far as possible. He holds it as conclusively proved, not only that forests on the mountains at the source of streams exercise an important function in regulating the flow of the latter, but that they are of hardly less importance in the plains traversed by those streams, as helping to bring into circulation, and so convert into an available asset, the water that would otherwise remain in the lower layers of the soil. In Russia the question is of special importance, inasmuch as, in the absence of mountain snows and glaciers, the rivers derive their sole supply from the forests and marshes, which are more and more threatened by the invasion of agriculture. Public attention has been called to the need for action, and something has been done by the planting of bands of forest, intersecting at right angles, and, while protecting the crops from drying winds, checking evaporation and encouraging transpiration and rain-production.

ASIA.

Dr. Philippson's Journey in Western Asia Minor.—The summer of 1901 was spent by Dr. Philippson, the well-known authority on the geography of Eastern Europe, in geological researches in the west of Asia Minor. Some of the results of the journeys, which extended over about 1200 miles, are sketched in the third number of the *Geographische Zeitschrift* for the present year. It was found that considerable alterations are necessary in the geological map of Western Asia Minor, based chiefly on the labours of Chihacheff. Most of the country is composed of late Tertiary fresh-water formations, the marine fossils mentioned by Chihacheff being found in one locality only. Associated with the Tertiary deposits are important volcanic outpourings of like age, the whole region showing signs of great disturbance. The late Tertiary deposits form a comparatively level fringe at the base of the crystalline ranges of Tmolos and Messogis, north and east of which, however, they form horizontal tablelands traversed by deeply eroded valleys, and gradually rising in level towards the Central Anatolian plateau. The whole tableland is broken by rift-valleys and sunk basins, one such area of subsidence—the basin of the Kaister—occurring even in the midst of the crystalline *massif* This is of later date than the rest, for the crystalline formation here falls directly to the alluvial plain, with no intervening Tertiary deposits, and the upper portions

of several of the valleys have been cut off by the subsidence. The tertiary deposits on the outer margin of Tmolos and Messogis are crowned by masses of loose *débris*, such as are found in Greece and Rhodes, and possibly indicating glacial action.

Journey in Persia.—The last volume of the *Memoirs* of the Russian Geographical Society (General Geography, vol. xxxvi.) is devoted to the report of the well-known zoologist, N. Zarudnyi, on his journey in Eastern Persia. An excursion which the author had made in 1896 having revealed the very great interest of a thorough zoological exploration of Persia, the Academy of Sciences sent out M. Zarudnyi, in 1898, to explore Eastern Persia, so as to connect his explorations with those of Blandford and St. John in Persian Baluchistan. Starting from Askhabad, the author went to Meshed, and explored the northern and western borders of Sistan; he next crossed the Sistan desert, and, proceeding *viâ* Gurmuk and Bazman, reached Bampur, thus connecting his work with that of the English travellers. From Bampur he returned, and when he had reached Askhabad, after an eight months' absence, he brought with him 2700 miles of route survey, as well as a survey of the region situated between Sistan and Bampur, which was very imperfectly represented on our maps, and a very rich zoological collection, which is now in the hands of various specialists. The present volume contains a general description of the journey, well written, and extremely interesting to the naturalist and the geographer.

The Coal Resources of India.—This important question was discussed by Prof. W. R. Dunstan in a paper read in February before the Society of Arts, and printed in the *Journal* of that body for March 21. The lecturer pointed out the ignorance which prevails in this country with regard to the practically inexhaustible supply of coal possessed by India, and the comparatively recent date of all serious attempts to exploit the wealth represented by that supply. In 1880 the total output from the Indian mines was but little over one million tons, of which 98 per cent. was produced in Bengal; while in 1900 the total output had risen to over six million tons, of which nearly five millions were contributed by Bengal. Another indication of the advance which has lately been made is the great drop in the quantity of foreign coal imported into India, which, though varying from 600,000 to 800,000 tons between 1885 and 1895, had fallen to 127,318 tons in 1900, the export of Indian coal showing, on the other hand, a marked rise and reaching a figure exceeding half a million tons in 1900. Before considering the individual coalfields and collieries, Prof. Dunstan sketches the general distribution of coal in India, showing that in the peninsula, including Bengal, the deposits are of Permio-triassic age, while elsewhere, as in Upper Assam, they are still more recent, mostly belonging to the Tertiary age. No considerable quantity of genuine coal is likely to be discovered in Southern India, where the formations are for the most part of older date than those which in India bear coal. The Bengal coal is somewhat bituminous, with rather a high percentage of ash; while the Tertiary coal of Assam is usually soft and bituminous, with a high percentage of volatile constituents. The total coal-area has been estimated at 35,000 square miles, and having regard to the extreme thickness of some of the seams, Prof. Dunstan considers that not only has India a supply which will soon render her independent of other sources, but that it may even be drawn upon by other nations whose coal deposits are now in process of depletion. Although Indian coal has been found to be from 17 to 20 per cent. inferior to British coal of the same type, the best qualities give good results when used on steam-vessels, and the consumption of Indian coal, both by steamers and on the Indian railways, is considered likely to expand rapidly. It is hoped that with improved facilities

for the transport and distribution of coal, an impetus will be given to many industries, and especially to the development of the mineral resources of the country. Prof. Dunstan urges the importance of further inquiries by Government into the extent of India's coal resources.

Malaria Investigations in Bengal.—The sixth series of Reports to the Malaria Committee of the Royal Society, issued in March last, gives some results of investigations in Bengal by Messrs. Stephens and Christophers, among which a paper on the relation of malarial endemicity to "species" of Anopheles is of much interest. An examination of the amount of "malarial endemicity" (*i.e.* the percentage of infection in the cases examined) at various points from Calcutta to the foot of the Himalayas—a distance of 300 miles—showed a steady rise, especially in the last part of the distance, from 0 to 72 per cent. (the latter being as high as in West Africa), the maximum occurring, as might be anticipated by all who know the reputation of the region in question, in the "Duars," or strip of country lying at the foot of the hills. It was also found that this increase in endemicity in the Duars was accompanied by the appearance of a new species of mosquito (to which the name *A. Christophersi* has been given), which also proved to be a good carrier, sporozoits being found in four out of sixty-four specimens examined, or 6·25 per cent.—a rate little lower than that frequently found in Africa. While allowing that more extended observations are necessary, the writers are naturally inclined to believe a connection between the high degree of endemicity and the presence of this mosquito, though they are willing to admit that a part of the effect may be due to the presence of non-immune coolies on the tea-gardens. They are, perhaps, inclined to minimize the climatic and other differences between the Duars and the more southern parts of Bengal, of which all who have lived in both districts for any length of time will be fully conscious. The spot at which the highest rate was observed is shown, on a sketch-map accompanying the paper, in close proximity to a wide tract of jungle—sparsely inhabited until recent years by Meches and other migratory tribes, and quite lately the scene of a considerable Santal immigration, which, no less than the opening of tea-gardens, has led to the turning up of much virgin soil. The possibility of a connection between a high rate of endemicity and the breaking of new ground for cultivation is, however, not discussed in the paper.

Zuallardo's Travels in Palestine.—A description of the work containing the account of Signor John Zuallardo's travels in Palestine in 1586 is given by Colonel C. R. Conder, in the January number of the *Quarterly Statement of the Palestine Exploration Fund* (1902). The volume, now somewhat scarce, was written by Zuallardo in old Italian, and published in Rome in 1587, under the title of 'Il Devotissimo Viaggio di Gerusalemme.' It is divided into five books, of which the third, containing the personal account of Palestine proper, is the most valuable, the others containing general information for intending pilgrims, and a compilation from older accounts of the topography of Palestine. The work is illustrated with engravings of places in Palestine from sketches made by the author, who claims to have been the first to attempt such drawings. Zuallardo left Venice on June 29, 1586, with a party which consisted of nine laymen and eleven clerical members. The sea-passage was broken at Zante, in the Ionian islands, and at Cyprus, where the party transhipped for Tripoli. After two unsuccessful attempts in native boats from both Cyprus and Tripoli, they landed safely at Jaffa on August 25. The best passages from Venice to Jaffa, as a rule, occupied from fifteen to twenty days. Mounted on donkeys, the party set off for Ramleh on August 29, and thence to Jerusalem, which was reached next day. They were not allowed to enter the city, but conducted south to the Franciscan monastery of St. Saviour on Sion.

Daily excursions were made in the neighbourhood of Jerusalem, including a visit to the Church of the Holy Sepulchre, where Zuallardo and two other members of the party were made knights of the Papal Order of the Holy Sepulchre. The journey was continued to Bethlehem and 'Ain Karim, and after another visit to the Greek monastery beside the Holy Sepulchre Church, the party returned to Jaffa on September 9, leaving again on the 11th, and reaching Tripoli on the 16th. Here Zuallardo waited until October 13 for a Venetian ship, and arrived again at Venice on the 23rd, after a rapid but stormy passage.

Expedition to the Tian Shan.—The well-known German geographer, Dr. Max Friederichsen, who published a year or two ago an excellent monograph on the Tian Shan, has undertaken an expedition to the range in company with the Russian botanist, Prof. Sapozhnikof. Especial attention will be paid to the neighbourhood of the Khan Tengri group in the central part of the range.

Tertiary Deposits at Okhotsk.—The fossils brought by Dr. Slyunin from Taui bay in the Sea of Okhotsk, east of the town of the same name, have been examined by Fr. Schmidt, who finds that they belong to the Cretaceous and the Tertiary period. The chief interest of the latter formations consists in their identity with those from the north-western portion of Sakhalin. In both localities we find Miocene sandstones and marls with remains of plants, and, close by, Pliocene sandstones of marine origin. Both have a wide extension, the Pliocene marine deposits covering the northern littoral of the Pacific ocean from California and Oregon, through the Aleutian islands, to Kamchatka, Okhotsk, Sakhalin, and Japan. Their fauna consists of molluscs, partly still living in the Behring sea, and partly extinct. Of the latter, the *Conchocele disjuncta* was found first in California, and subsequently in Japan, Sakhalin, and Okhotsk. The *Mytilus Middendorffi*, Grew., from the Aleutian islands and Sakhalin, has now been found near Okhotsk. As to the *Turritella erosa*, Couth., a small modern representative of this species still lives in various parts of the Arctic sea. The Miocene deposits found on the Okhotsk littoral belong to a formation which is now well known from Sakhalin, California, Oregon, the former Russian America, Japan, and Kamchatka. Among the fossil plants of Okhotsk, the widely spread *Carpinus grandis*, Ung., the *Betula Brogniarti*, Heer, the *Corylus McQuarrii* and *Populus Zaddachi*, Heer, are worthy of notice. Cretaceous deposits have hitherto been found in one spot only. They are similar to the sandstones appearing on Sakhalin (at Due), and are full of shells of the big *Inoceramus Cuvieri*, Goldf., in Okhotsk, while the Sakhalin species belongs to *I. digitatis*, Sow., now described as *I. Schmidtii*, by Michelson (*Verhandlungen of the St. Petersburg Mineralogical Society*, 2nd series, vol. xxxviii. 2).

Lake Baikal.—The members of the hydrographical expedition under Colonel Drizhenko, which is to continue the exploration of Lake Baikal during the present summer, have started for Irkutsk.

The Old States of Sumatra.—In the sixteenth instalment of the 'Geographical Notes,' in which Mr. G. Schlegel has contributed not a little to the elucidation of the historical geography of the far East, the author gives the results of his researches as to the ancient states of the island of Sumatra as described by Chinese and other early writers. The questions to be solved present many difficulties—firstly, from the fact that a knowledge of the old pronunciation of Chinese characters, as well as of local dialects, is a necessary qualification for the task; and, secondly, because not only have the old names undergone great changes in course of time, but in many cases the places to which they were applied seem to have ceased to exist, though known to De Barros and even later authorities of the European period. Thus the powerful fourteenth-century state of Sumundara, from which the name Sumatra itself has come down to us, is represented at the

present day only by the miserable village of Samudra, near Pasei. Palembang, which has long been an important political centre, seems to have three times changed its name during the Christian era. One of the names, the Chinese San-fuh-thsi, to which Mr. Schlegel devotes much attention, as it has puzzled many commentators, is, in his opinion, to be read as Semboja, which, like its variant Kemboja (the modern Cambodia), he explains as the name of the well-known tree with scented flowers, *Plumeria acutifolia*, quoting as analogous instances of the naming of places from trees the existence of many villages called after the celebrated Champak (*Michelia champaka*). The Nakur of the Chinese, inhabited by naked people with apes' faces, is the Necuran of Marco Polo, Vacumeran of Odoric (who says that the natives had dogs' faces), which has wrongly been identified with Nankuri, one of the Nicobars. The Li-te of the Chinese (Lide of De Barros) is a name which has entirely disappeared from modern European maps, although, thanks to De Barros' list of Sumatran states arranged in the order in which they occurred round the coasts, its position can be satisfactorily determined. Another name which has totally disappeared in modern times is that of Baros on the south-east coast, which is mentioned by the Buddhist pilgrim I-tsing in the seventh century A.D. (possibly also by Ibn Khordadbeh as "Balus"), and still appears on one or two European maps of the seventeenth century. It is to be distinguished from the modern Baros on the West Coast, which was known to Marco Polo, in the Arab period, as Fansur, the kingdom in which grew the best camphor in the world.

AFRICA.

Ascents of Mounts Kilimanjaro and Meru.—It is announced in the *Geographische Zeitschrift* that a new ascent of Kilimanjaro was made last autumn by Dr. Carl Uhlig, an official of German East Africa. The unfavourable ice-conditions on Kibo prevented much new work at the top, but Dr. Uhlig obtained a good series of photographs, and during a subsequent excursion was able to add to our knowledge of the southern glaciers, making his way alone to the Decken and Kersten glaciers seen from a distance by Meyer, but never before reached. Botanical and geological collections were also made. Dr. Uhlig also succeeded in ascending to within 100 feet of the summit of Mount Meru, of which no previous traveller had climbed more than the lower half. A wall of rock prevented the ascent to the actual summit, the highest altitude reached being about 15,400 feet. On the way to the mountain Dr. Uhlig examined some small steppe lakes.

Mr. Seton-Karr's Antiquarian Discoveries.—Mr. W. W. Seton-Karr has returned from his ninth journey into Somaliland, having revisited Zalelo, where on previous occasions he discovered such large and perfect stone implements, thought to be Palæolithic, and, if so, completing the chain of evidence connecting Europe with the East as regards intercourse in pre-glacial periods. Mr. Seton-Karr has presented a part of his collections to the Indian Museum at Calcutta, in which he has arranged a new prehistoric gallery. On his way back to Europe he paid a visit to the Nicobar islands.

The Du Bourg Expedition in Abyssinia.—News has lately been published as to the progress of the expedition under M. Du Bourg de Bogas, the departure of which was announced some months back in the *Journal*. From Harrar the French traveller is said to have gone south to Ime, and thence westward into the little-known hilly country inhabited by the Arussi Gallas. It was proposed afterwards to visit the Ogaden country.

Exploration of the Upper Sanga Basin.—The *Mouvement Géographique* for April 13 contains a short account of a journey of exploration in the upper

basin of the Sanga, lately carried out by M. Kerremans, agent of a French company, by which the mapping of that part of the Sanga system has undergone some modification, especially as regards the course of the Kadei, hitherto known chiefly through the journey of Perdrizet. The source of the main western feeder of the stream has been recently located by Baron von Stein in the Kamerun, so that, with M. Kerremans' survey of the middle part of its course, the general features of its hydrography are now known pretty accurately. The Kadei and the Mambere, or eastern branch of the Sanga, both rise in the highlands of Ngaumdere and traverse an elevated tableland sloping towards the south-east, and finally falling in a series of abrupt steps to the great plain of the middle Congo. The part of the Kadei explored by M. Kerremans is broken by an almost continuous series of rapids. The inhabitants of the country belong for the most part to the Baya stock, and show less of the pure negro blood than the other tribes of the Sanga. Mussulman influence is gradually making its way from the north, and the Hausa costume—the cloak with wide sleeves—is not unfrequently seen. The huts are round, as in the Sudan, in the north, but often rectangular in the south.

AMERICA.

Biological Station on the Great American Lakes.—A bill has been brought before the United States Congress for the provision of funds for the establishment of a biological station on the North American lakes. The main objects held in view by the promoters of the scheme, chief of whom is Prof. J. Reighard, are, as we learn from *Science*, the investigation of the problems connected with the whole of the lake fisheries, such as the breeding times, places, and conditions of the fishes, the decrease or increase of special kinds, and generally the study of the conditions and regulations necessary for successful fish-culture.

Proposed Raising of the Level of Lake Erie.—We learn from the *Geographische Zeitschrift* that a scheme has been set on foot in the United States for the raising of the level of Lake Erie by means of a dam at its outlet. The object of such a work would be the deepening of all the Lake Erie harbours to the extent of 3 feet, and of the navigable channel in the St. Clair and Detroit rivers by 2 feet. It would also help to raise the level of Lakes Huron and Michigan, which has fallen of late years by about a foot, owing to the deepening and widening of the rivers leading to Lake Erie, and the construction of the Chicago drainage canal; while the deepening of the Lake Erie harbours and of the rivers above named by any other means would be much more costly, and would only exaggerate the fall in the level of the two upper lakes. The scheme is said to have met with some opposition in Canada, from the idea that the low-water supply of the St. Lawrence would be diminished. It is pointed out, however, that the dam would not alter the total annual discharge from Lake Erie, but only modify its distribution through the year. The scheme has been referred to a mixed Board of American and Canadian engineers.

Bering and Chirikof on the North-west Coast of America, 1741.—Prof. George Davidson, whose researches on the voyages of the early Spanish and English navigators on the north-west coast of America are well known to students of historical geography, has lately undertaken an investigation of the voyages of Bering and Chirikof on the southern coasts of Alaska in 1741, with a view to clearing up the many doubtful points as to the tracks of their vessels and the various points on the coast touched at. The writer considers that Bering's conduct of the expedition has been the subject of unfair criticism, and he takes pains to show the enormous difficulties against which the commander had to contend, and the really wonderful nature of the work accomplished in view of the conditions

under which the task was undertaken. "The difficulties to be overcome," he insists, "demanded a man of supreme self-reliance, great physical ability, and large resources. And it may be asserted that until Bering was attacked by scurvy he was equal to all emergencies." After tracing the former work of Bering and the events which led to his last great expedition, Prof. Davidson examines in detail the courses of the *St. Peter* and the *St. Paul*, commanded by Bering and Chirikof respectively, from their separation in bad weather in about 49° N., 179° W. (after a fruitless search for the mythical land of Jean de Gama, supposed to lie to the east of Japan), to their eventual return to the same meridian after coasting along the Alaskan shores. During the whole of this time the ships never joined company, though their tracks crossed and recrossed each other, and they were at times apparently not many miles apart. From their respective most southerly points in about 176-178° W., both commanders sailed generally north-east until they struck the American coast, the landfall of Chirikof (July 15) being probably at Cape Addington in about 55½° N., while the first point of land sighted by Bering was Mount St. Elias (July 16). Among the special points investigated the most important, perhaps, are—(1) The identity of the bay at which the disaster to Chirikof's boat-party took place; this is considered to be almost certainly Sitka sound. (2) The position of Bering's Cape Hermogenes, which Prof. Davidson identifies with the south point of Sakhlidak island in 57° N., 153° W. The name was, it seems, erroneously bestowed for that of St. Ermolai, on the day of which saint it was sighted. (3) The tracks of the two vessels during the calm weather from August 8 to 30, during which they probably (on the 16th) approached within 15 miles of each other. The grounds of Prof. Davidson's conclusions are not always stated so fully as could be wished, for though he frequently enters into descriptions of portions of the coast as now known, it is not always clear, without turning to the original narratives, how far these supply the means of identification by their own descriptions. He has, however, evidently given much careful study to the questions, and his personal acquaintance with much of the coast makes him particularly well qualified for the task of elucidating the voyages. A large-scale chart shows the tracks of the vessels with much minuteness.

Navigation of the Tanana.—Hitherto, although small vessels have ascended its lower portion, no serious attempt at the navigation of the Tanana, the largest tributary of the Yukon, has been made. The United States consul at Dawson reports that at the end of last autumn, the *Lavelle Young*, of Portland, Oregon, a 500-ton steamer drawing 4 feet of water, navigated it to a distance of 310 miles from its junction with the Yukon. The mouth of the river is nearly 2 miles wide, and is almost closed by a sandbar with a navigable channel of only 4½ feet. Here the current is only 3 miles per hour, but after the first 100 miles, it increased on an average about 2 miles an hour for each succeeding 100 miles. The river is described as having many islands and sandbars, causing the water to divide into numerous channels, somewhat like the Yukon between Fort Hamilton and Circle city. The Valdes trail was known to cross it at 480 miles from the mouth, and it was hoped that this point might be attained, but the vessel grounded at the 310th mile, and no channel could be found with sufficient water to continue. The river has some considerable tributaries. At 60 miles from its mouth it is joined by Baker creek, at 80 miles by the Kantitna, at 86 miles by the Fulvana, and at the lower end of the Bates rapids, some 300 miles up, by the Chenoa. All these streams are navigable for small steamers for a distance of from 50 to 100 miles, and the last-named was ascended for some distance by the *Lavelle Young*. It is stated that the country in the neighbourhood of the Tanana has all the appearance of possessing rich mineral deposits.

Volcanic Eruption in the West Indies.—The appalling disaster which overtook the islands of Martinique and St. Vincent during the first half of May through the eruption of their volcanoes, must rank among the most terrible visitations of the kind, although the destruction wrought has no doubt been surpassed on many recorded occasions, including that of the famous eruption of Krakatau some twenty years ago. In the suddenness and completeness of the ruin, the Martinique catastrophe, at least, lacks no element of impressiveness. It is not easy, from the fragmentary telegraphic intelligence received during the progress of the eruption, to piece together a connected account of the catastrophe, or to trace clearly the date of the first threatenings of disaster. The climax of the eruption on Martinique, by which the whole town of St. Pierre, the largest in the French West Indies, with its 30,000 to 40,000 inhabitants, and almost the whole of the shipping in its roadstead, were completely wiped out of existence in a few short minutes, took place on the morning of May 8, but signs of activity had been shown some days before by Mont Pelée, the highest point of the island, which for many years had reared its verdant summit to a height of 4400 feet, only a few miles from the doomed town. The volcano had been quiescent for just over half a century, the last eruption—and that not of the first magnitude—having taken place in 1851. According to one account, the first flow of lava began on May 3, and in any case this had become so serious before May 6 as to completely destroy the Guérin factory, 2 miles from St. Pierre. On the 7th a state of panic existed in the town, whither the French Governor, M. Mouttet, proceeded with a view to allaying apprehension, being persuaded that the worst was already over. At 8 a.m. on the 8th the climax came, St. Pierre being overwhelmed in a moment by a fiery cataclasm, accompanied, according to some observers, by a poisonous choking whirlwind, which left not a soul alive of the whole population of the town, while thousands were left homeless and destitute in neighbouring parts of the island, and eighteen vessels are said to have been destroyed. Besides the governor and other officials, both the British and American consuls were among the victims. The whole northern end of the island, which became for a time a sea of fire, was afterwards observed to be covered with a silvery-grey coating of ashes. Stones and ashes also fell at Fort La France, some 14 miles off, and intense darkness prevailed in many parts of the surrounding region. Refugees who arrived at Dominica on the 12th, reported that the volcano was still active, new craters being in course of formation, while rivers had overflowed their banks, submerging large areas. The sympathetic eruption of the famous "Souffrière" of St. Vincent, though somewhat less destructive, has still brought a terrible calamity on the island, the deaths being reported to exceed 1600. Earthquake shocks had been felt for some time, when, apparently on May 5, a loud explosion took place, giving rise to a cloud of steam. Many separate outbursts occurred within the next few days, the volcano sending forth clouds of smoke and steam, with stones and ashes, which fell thickly both at Kingston and Georgetown. The whole northern third of the island is said to have been involved, and the Souffrière had the appearance of a scarred smelting furnace, while huge chasms were formed and a new valley opened. The volcano had been much longer quiescent than that on Martinique, the last eruption having been the famous one of 1812—the final act in the prolonged series of far-reaching seismic phenomena described at length by Humboldt in his 'Personal Narrative,' and more briefly in Kingsley's 'At Last.' Since 1812 the mountain had possessed two distinct craters side by side, each occupied by a lake.

The Koppename Expedition in Dutch Guiana.—This expedition, to which reference has more than once been made in the *Journal*, returned to Paramaribo in

November last, having failed to reach the water-parting, and returned as it went, by the Koppename. From the point above the Raleigh falls reached in August (*Journal*, vol. xviii. p. 625), the river was ascended in the boats as far as 4° 9′ 40″ N., beyond which Mr. Stockum made his way in a canoe to 3° 57′ 40″ N., 56° 49′ 40″ W., at which point the stream became a mere brook. This point was 112 miles by river above the Raleigh falls. Another branch of equal size, which entered on the right, was ascended to 3° 59′ 15″ N., 56° 22′ 15″ W., but, owing to the rapid fall in the level of the water, the tributary entering the main stream on the right above the Raleigh falls could only be traced upwards during two days' journey. Meanwhile surveys had been carried out from various hilltops, and the return voyage down the Koppename was begun on October 25.

Regulation of the Paraná River.—The outer part of the La Plata estuary has two waterways, separated by a group of banks. The deeper channel lies along the coast of Uruguay, and is the one used by ocean-going vessels. Those bound for Buenos Aires ascend the estuary to Montevideo, and then make for the Argentine coast, passing over the Barra del Indio, over which there is only 17¾ feet of water, and then follow a channel which runs up to the city. The eastern channel has a fair depth beyond Montevideo, but is blocked below Puerto Sauce. The delta of the Paraná river is formed by the Rio de las Palmas and the Paraná Guazu, which again divides into a number of arms. From Buenos Aires, the most direct route to the Paraná is by the Rio de las Palmas, but owing to a bar in front of its mouth, this entrance can only be used by vessels drawing less than 9 feet, and others have to make a *détour* round the bank called Playa Honda to the Uruguay coast, pass through the Martin Garcia channel, now being dredged out to a depth of 21 feet, and enter the Paraná Guazu. Probably the Rio de las Palmas was at one time the most important mouth of the Paraná, but as the delta was pushed further out, the bulk of the water sought a shorter way to the La Plata, and each of the other mouths became in turn the chief channel. Now the Rio Bravo is preferred to the main Paraná Guaza, its depth being greater. That the Paraná de las Palmas has not been closed at the mouth is due, according to Sr. A. Foster, to the tide which heads against the Argentine coast. His plan for the improvement of the navigation (*Anales de la Soc. Cientifica Argentina*, tom. lii. No. 5) is to shorten the length of the Las Palmas river by cutting two channels across the bends it makes near its junction with the Paraná Guazu, and thus restore its former pre-eminence. One of these channels would move the junction above the Isla del Dorado, where, with the diminished volume of water, the silt would accumulate, so that the water flowing down the Las Palmas would be further increased. In consequence, the bar of the Rio de las Palmas would, Sr. Foster believes, be moved further out where the waves are larger, and capable of acting more strongly upon it. The length of the Palmas thus rectified would be 60 miles, as compared with 72 for the Guazu or 70 by the Rio Bravo mouth. The distance from Buenos Aires to the Paraná ports would be shortened by about 60 miles, and their foreign trade would pass by the city.

AUSTRALASIA AND OCEANIC ISLANDS.

Memorial to Captain Flinders.—An interesting ceremony was performed in March last by Lord Tennyson, Governor of South Australia, at the summit of Mount Lofty, in honour of the explorer Matthew Flinders, whose celebrated meeting with the French expedition under Baudin on the South Australian coast took place on April 8, 1802, or just a century ago. Mount Lofty has long been crowned with a white obelisk 50 feet high, originally intended as a monument to Flinders, but never formally recognized as such. The ceremony alluded to consisted in the

dedication of the column to the memory of the navigator, and the unveiling of a tablet commemorating the discovery and naming by Flinders of Mount Lofty on March 23, 1802, and the friendly meeting of the officers of the *Investigator* and *Géographe*, commanded by Flinders and Baudin respectively. An illustrated account of the ceremony is given in the *Adelaide Observer* of March 29, which contains the portraits of members of the Flinders family now resident in South Australia.

Exploration in South Australia.—An exploring trip through the western interior of South Australia was undertaken last year by Mr. R. T. Maurice, accompanied by Mr. W. R. Murray, whose brief report on the journey to the Minister of Mines at Adelaide has been printed by order of the House of Assembly, together with a sketch-map of the route followed. The starting-point was the Yalata Station on Fowler's bay, whence the explorers went north to the Paraminna dam in about 29° S., and north-west across the Western Australia border to the Jameson and Rawlinson ranges, returning by a more northerly route along the Mann and Musgrave ranges. The northern part of the Nullabor plains was found to be well grassed, the winter being an unusually good one, and Mr. Murray thinks that in spite of its drawbacks it may in future be utilized for pastoral purposes. It is, however, discouraging to learn that rabbits are getting plentiful, and are already damaging much of the bush herbage. North from the plain the country consists of alternating sandhills and flats, the former being in general the best off as regards water, owing to the non-retentive nature of the subsoil of the flats, which causes the vegetation to be ephemeral in character, even the mulga being unable to thrive. Wherever the blacks have fired the country an excellent young growth springs up after the next rain. The expedition was particularly fortunate in meeting with water, many of the watering-places being apparently permanent, so that in future the task of travelling from the coast to the northern ranges will be much lightened. From a prospector's point of view the country is unpromising until the ranges are reached, but here the geological age and the character of the rocks are said to be distinctly encouraging, quartz reefs which assays proved to contain traces of gold being frequent in the Cavanagh and Rawlinson ranges. Transit, however, entails heavy expenses, and mining operations would probably be more profitable in many districts near Adelaide. No trouble was experienced with the natives, though they were very shy in the west and north-west.

Intercolonial Water Rights.—In the current volume of the *Journal and Proceedings of the Royal Society of New South Wales* (vol. xxxiv. 1900), Mr. H. G. McKinney discusses the subject of "Intercolonial Water Rights as affected by Federation." In explanation of the magnitude and importance of this question, it is pointed out that the drainage area of the Murray river is shared by four colonies as follows: New South Wales over 234,000 square miles, Queensland nearly 105,000 square miles, Victoria nearly 51,000 square miles, and South Australia over 24,000 square miles, making a gross area of 414,000 square miles. In seasons during which the rivers are high, the length of navigable river is 3213 miles. While the Inter-State Commission to be appointed by the Federal Parliament will have charge of the navigation on these rivers, it is not to interfere with "the reasonable use of the waters of rivers for conservation or irrigation." A brief outline is given of the nature of the principal difficulties with which the Inter-State Commission will probably have to deal in connection with the rivers of New South Wales, as also a statement of the present condition of affairs in regard to water rights in this state. In Queensland the question of water rights on the rivers is practically untouched. In New South Wales numerous rights to water have been granted, but on such a limited scale that they cannot be regarded as any

infringement of navigation rights. But in Victoria extensive works for water conservation and irrigation have been constructed, and rights to large quantities of water have been granted; while in South Australia, the water rights which have been granted, though on a much more limited scale than in Victoria, are of greater importance than those granted up till the present in New South Wales. A map illustrating the drainage area of the Murray river accompanies the paper.

Disaster to a French Expedition in New Guinea.—A recent number of the *Deutsche Rundschau für Geographie* gives some particulars of a disaster which has lately happened to a scientific expedition despatched in 1900 by the Paris Journal *La Patrie* to the island groups between Borneo, Celebes and New Guinea. Most of the members of the expedition—four Frenchmen and twenty-one natives—have, according to this account, been murdered by the New Guinea cannibals. On January 1 the ship of the expedition touched at the coast near the British and Dutch boundary, and, meeting with an apparently friendly reception from the natives, the explorers pitched their camp on land. At 1 a.m. they were roused from sleep by a murderous attack, and soon overpowered. One of the party, Dr. H. Rouyer, was stunned by a blow on the head, and on coming to found that he had been bound and carried off by the natives. Fortunately, he had the presence of mind to give no sign of life, and he was soon afterwards rescued by a party from the ship, which, however, came too late to save his companions, among whom was Baron Villars.

POLAR REGIONS.

The Swedish Antarctic Expedition.—The *Antarctic* returned to Tierra del Fuego early in March with a portion of the personnel of the expedition on board, after landing Dr. Otto Nordenskiöld and five companions at the winter station on the east side of Graham Land. Letters received from both the leader himself and Dr. Gunnar Anderson, the biologist of the expedition, give some account of the progress of the work down to the beginning of April. Leaving Staten island—the site of the magnetic observatory established by the Argentine Government for co-operation with the Antarctic Expeditions—on January 6, the *Antarctic* sailed south across Drake strait with a light wind and an almost smooth sea, no ice being in sight during the whole passage. On the 11th the first Antarctic land—King George island in the South Shetlands—came in sight, presenting, with its unbroken mantle of ice and snow, a scene of unsurpassed desolation, which contrasted strongly with the almost tropical luxuriance of the last lands left behind. The ship put into a cove on Nelson island, where a small extent of ground was found free from snow, with a certain amount of vegetation in the shape of mosses, lichens, and algæ, affording a home to many small insects, and even a small beetle, the first ever found in the Antarctic. The poverty of the land was, however, far greater than is ever the case in the Arctic, while on the other hand the sea revealed a wealth of life which could hardly be surpassed, and which included not only shrimps and other of the lower forms, but fish in astonishing numbers, with multitudes of whales and seals. Continuing the voyage, the explorers entered the channel shown by D'Urville on the west side of Louis Philippe land, which they had suspected to be an island, but which proved to be only the extremity of the land-mass known as Graham Land. In order to reach the east coast it was thus necessary to double the northern point, an attempt being then made to follow the coast of King Oscar Land southward. It proved unsuccessful owing to the immense masses of ice which extended to the arctic circle, and after sounding and dredging along the edge of the pack, Dr. Nordenskiöld turned towards the land on February 12 to prepare the winter quarters at Admiralty inlet, Snow Hill Land, south of Cockburn

island. The geological formation is here Mesozoic sandstone associated with basalt, and the ice promised to be favourable for sledge journeys, by which Dr. Nordenskiöld hopes to explore the land during the winter months. He expects to see the *Antarctic* once more about the end of November, and after continuing the work at the station till the end of the year, to be back at the Falklands in February, 1903. The ship left the winter station on February 21, and, after coaling at Ushuaia, proceeded to the Falkland islands *en route* for South Georgia for the purpose of hydrographical and biological investigations.

The New Voyage of the "Windward."—Before starting north this summer to effect a junction with Peary's Expedition, the *Windward* is being thoroughly overhauled and made more suitable for ice-navigation than she has hitherto proved. The old engines being found of insufficient power, they are being replaced by others of more modern type, capable of giving something like 300 H.-P., and a speed of seven knots, or equal to that of the best equipped of the Newfoundland sealing-fleet. The boilers will also be of the modern high-pressure type, and, like the engines, are being installed by Messrs. Marvel & Co. of Newburg, N.Y. It is expected that the work will be completed by June 20, and the ship will then sail immediately, as it is considered that the conditions in Smith sound are more likely to prove favourable earlier in the season than the sound has hitherto been navigated by the Peary expeditions. The explorer is expected to be found at Etah, returned from his dash for the north.

Arctic Exploration.—The members of the Russian Arctic Ocean expedition are already leaving St. Petersburg for Archangelsk. The expedition is under Captain Warneck, and consists of Captains Serguéeff and Morozoff, Lieuts. Yanoff, Brovtsyn, and Kozlauinoff, and Dr. Paliloff. They will first explore the yet unexplored bays of the Murman coast; then, in July, they will start for the Kara sea—the intention being to explore and to map carefully the Kara strait, and to complete the mapping of the Matochkin Shar; and then, entering the Kara sea, to map its eastern coast (the Yalmal peninsula). If the state of the ice does not permit this work to be done, the mouth of the Pechora will be mapped instead.

GENERAL.

New German Scientific Publication.—It has been decided by the Geographical Institute of the University of Berlin to issue, jointly with "Institut für Meereskunde" (both of which bodies are under the direction of Baron von Richthofen), a publication embodying the results of geographical and oceanographical research in a series of parts to be published at irregular intervals. The first part has already appeared, and deals with the scientific results of the voyage of the *Gauss* to Cape Town, from the reports of several observers; while several other papers are in course of preparation. The publication is of octavo size, and its external form is well worthy of the prospective value of the papers from a scientific point of view. A building is in course of erection for the two institutes, and will contain a museum which is being organized by the "Institut für Meereskunde."

New Colonial Bibliography.—We have received the first numbers of a new publication, issued by the "Union Coloniale Française," which is likely to prove helpful to students and others in view of the flood of colonial literature resulting from the increased attention directed of late years by European nations to the development of their colonial possessions. Under the title *Bulletin Bibliographique Coloniale*, it supplies not merely a catalogue of all the most important publications relating to colonial affairs, but a succinct *résumé* of their contents or general bearing, enabling those who have not the leisure to read the original papers to obtain a general grasp of the results of modern literary activity in this direction.

A New Geographical Society.—During the last Congress of Russian Naturalists the section of geography nominated a special committee for the discussion of all questions relative to the teaching of geography in secondary schools. At the present time a "Society of Earth-knowledge" (*Obschestvo Zemlevedeniya*) has developed out of that committee. It will be connected with the St. Petersburg university, and undertakes to promote the study of scientific *Erdkunde* by means of lectures, congresses, publications, excursions, and so on.

The Artesian Water-supply of Australia.—On p. 576 of the May number, in the discussion on Mr. Cox's paper, the words "with reference to the above, Mr. Cox writes," should be placed before the succeeding paragraph.

OBITUARY.

Sir Andrew Clarke.

Lieut.-General Sir Andrew Clarke, G.C.M.G., C.B., C.I.E., is the third, in less than two months, whose death has removed from the list of Fellows a distinguished servant of the State. He had long been in failing health, and died on March 29, when within four months of completing his seventy-eighth year. Of Sir Andrew Clarke, as of the Marquis of Dufferin and Sir Richard Temple, it may be said with truth that, if he could not claim to rank as an explorer, he was assuredly one of the most widely travelled of men. It was only to be expected, therefore, that he would take an interest in geography, and that such was the case is sufficiently attested by the fact that for over forty years—from 1859—he was a Fellow of the Royal Geographical Society. Born on July 27, 1824, the son of the first Governor of Western Australia, Clarke obtained a commission in the Royal Engineers in 1844. After service in Ireland, Tasmania, and New Zealand, he was appointed, in 1853, Surveyor-General of Victoria. The constitution of that colony, drawn up in 1855, was largely his work, and in the first responsible administration he held office as Minister of Public Lands. Returning to India in 1858, he was sent on a special mission to the Ashantis in 1863, and was subsequently appointed Director of Works to the Navy, in which capacity he materially strengthened the imperial defences. The year 1873 found him in the Straits Settlements, as governor and commander-in-chief, and though he only remained there two years, he succeeded in that time in bringing the Malay States under British protection. Then, after carrying to a successful issue an important mission to Siam, he became Minister of Public Works for India, and having ably filled that post for more than five years, was appointed, in 1882, soon after his return to this country, Inspector-General of Fortifications. In 1886 he was placed on the retired list, and three years later became Agent-General for Victoria, an office which he filled, except for a brief interval, until his death.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1901–1902.

Tenth Ordinary Meeting, April 28, 1902.—Sir CLEMENTS MARKHAM, K.C.B., F.R.S., President, in the Chair.

ELECTIONS:—*Rev. Alfred Armitage, M.A.; Major-General Joseph Herbert Bedford, R.E.; Lieut. T. Tunstall Behrens, R.E.; Major Henry Wightman Benson, D.S.O. (E. Surrey Regt.); Commander John Brown (R.M.S. "Ionian"); Harold E. Byrne; Rev. Wm. Hargreaves Cooper; Lieut. George Rochefort Cox; Rev. Samuel John Deutschberger; Frederick William Emett, F.R.C.I.; William Hunter Gandy; J. Stanley Gardener, M.A.; James Golding; Captain C. V. C. Hobart, D.S.O. (Gren. Guards); Lieut.-Colonel Lovick Bramley Friend, R.E.; Lombard Carter Jones, M.D.; Colonel Fortescue John Nason, D.S.O. (Cameronians); Maurice Newton; Montagu Austin Phillips, F.Z.S.; Captain C. H. D. Ryder, R.E.; Lieut. Basil Heron Shaw-Stewart, R.F.A.; Captain G. E. Tyrrell, R.A.; Henry Hulton Vignoles (late 5th Dragoon Guards); Captain J. F. Whyte (Indian Staff Corps); Joseph Wilson.*

The Paper read was:—

"Trade Routes in Eastern Persia." By the Earl of Ronaldshay and Edward Penton, Esq.

Eleventh Ordinary Meeting, May 12, 1902.—Sir CLEMENTS MARKHAM, K.C.B., F.R.S., President, in the Chair.

ELECTIONS.—*Haden Adam, A.C.P.; Lieut. George H. Arnot, R.N.R.; Henry Gordon Gooch Ashton; Sir Edgar Collins Boehm, Bart.; Dr. Cuthbert Christy; Lieut.-Colonel G. C. Herbert (Royal Fusiliers); Wm. Ellis Jardine (India Civil Service); Rev. John Smith Lontil; Colonel B. Mahon, C.B., D.S.O. (Governor of Kordofan); George Henry Morrell; Dr. Henry White.*

The PRESIDENT said: Before commencing the business of the evening I think I may refer to the expedition of Dr. Nordenskiöld, who is a nephew of that great explorer our late Gold Medalist, Baron Nordenskiöld, and who has already distinguished himself by his explorations and discoveries in Patagonia. He got up a small antarctic expedition with very great difficulty in Sweden, and fitted out a small vessel and planned the work he intended to do admirably. He has had himself put on shore on the eastern coast of Graham's Land, where he intends to winter with one or two scientific men, while the ship returns to do useful work in the seas between Tierra del Fuego and South Shetland. In the mean while, Nordenskiöld will winter on that coast, and no doubt, with his very small means, he will do a great deal of exceedingly good work, both in natural history and in his meteorological observations. We had the great pleasure of giving him a send-off when he came to London on his way.

I would also allude to the relief ship which we are now fitting out to follow the instructions given by Captain Scott, who is now with his gallant companions passing the antarctic winter in some part of those regions to us unknown, and which will be unknown to us until next April. Meanwhile, we have a strong although rather old ship, and we are fitting her out to take those provisions and coals which will be required by Captain Scott, and to succour him in case there has been any accident with the *Discovery*. I may say that all is going well, and that the ship will certainly start at the time fixed, the first week in July.

The Paper read was:—

"On Snow-waves and Snow-drifts in Canada." By Vaughan Cornish, D.SC., F.G.S.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.	Mag. = Magazine.
Abh. = Abhandlungen.	Mem. = Memoirs, Mémoires.
Ann. = Annals, Annales, Annalen.	Met. = Meteorological.
B. = Bulletin, Bollettino, Boletim.	P. = Proceedings.
Com. = Commerce.	R. = Royal.
C. Rd. = Comptes Rendus.	Rev. = Review, Revue.
Erdk. = Erdkunde.	S. = Society, Société, Selskab.
G. = Geography, Geographie, Geografia.	Sitzb. = Sitzungsbericht.
Ges. = Gesellschaft.	T. = Transactions.
I. = Institute, Institution.	V. = Verein.
Iz. = Izvestiya.	Verh. = Verhandlungen.
J. = Journal.	W. = Wissenschaft, and compounds.
k. u. k. = kaiserlich und königlich.	Z. = Zeitschrift.
M. = Mitteilungen.	Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. — **Lapparent.**
Le Problème Alpin. Par A. de Lapparent. Extrait du *Correspondant*. Paris: De Soye et Fils, 1902. Size 9½ × 6½, pp. 30. *Presented by the Author.*

Discusses the origin of the Alps.

Alps. — **Moore and Kennedy.**
The Alps in 1864. A private journal by A. W. Moore. Edited by Alex. B. W. Kennedy. Edinburgh: D. Douglas, 1902. Size 10 × 6½, pp. xxxvi. and 444. *Maps and Illustrations. Presented by the Publisher.*

This will be specially noticed.

Austria. *Petermanns M.* 48 (1902): 9–11. **Crammer.**
Karren und Dolinen im Riffkalk der Übergossenen Alm. Von Prof. Hans Crammer.

Austria—Bosnia and Herzegovina. *Globus* 81 (1902): 149–150. **Grund.**
Neue Eiszeitspuren aus Bosnien und der Herzegowina. Von Dr. Alfred Grund.

Austria—Istria. *Abrégé B.S. Hongroise G.* 28, Nos. 5–10 (1900): 24–27. **Czink.**
Lussino, Isola dell' Istria. Prof. L. Czink. (From *Földrajzi Közlemények*, 28 (1900): 173–197).

Baltic—Fauna. *Ymer* 21 (1901): 361–373. **Andersson.**
Ett bidrag till Östersjöns djurgeografi. Af J. G. Andersson. *With Map.*

On recent investigations of the Baltic fauna.

Baltic Sea. — ———
Instructions for Sailing from Kronstadt to Vladivostok and return. II. (In Russian.) St. Petersburg, 1901. Size 9½ × 6½, pp. xvi. and 326. *Chart and Illustrations.*

This part deals with the Baltic and its approaches.

Denmark. — **Thomas.**
Denmark Past and Present. By Margaret Thomas. London: A. Treherne & Co., 1902. Size 7½ × 5, pp. x. and 302. *Illustrations. Price 6s. net. Presented by the Publishers.*

The first part of this book is descriptive of the towns and country districts of Denmark, which the author recommends to tourists as, "comparatively speaking, a

virgin land, undeteriorated by the extravagances of the millionaire, or the vulgarity of the casual tripper," while possessing natural and historical attractions of special interest to natives of the British isles. The second part gives a sketch of the institutions, literature, and history of the country.

Europe—Geodesy. ——

Veröffentlichung des Königl. Preussischen Geodätischen Institutes. N.F. No. 7. Astronomisch-Geodätische Arbeiten I. Ordnung. Bestimmung der Längendifferenz Potsdam—Pulkowa im Jahre 1901. Berlin: P. Stankiewicz, 1902. Size 11½ × 9, pp. ii. and 56. *Presented by the Institute.*

France. *Petermanns M.* **48** (1902): 30–38. **Engell.**

Beiträge zur Kenntnis der geographischen verhältnisse von "Les Landes." Von Dr. M. C. Engell.

See note in the Monthly Record (*ante*, p. 750).

France. *Ann. G.* **11** (1902): 24–42. **Fabre.**

L'érosion pyrénéenne et les alluvions de la Garonne. Par L. A. Fabre. *With Plates.*

France. *Globus* **80** (1901): 297–302, 315–323, 334–339. **Friederichsen.**

Beiträge zur geographischen Charakteristik der Bretagne und des französischen Zentralmassivs. Von Dr. Max Friederichsen. *With Illustrations.*

An instructive study in physical geography.

France. *B.S.G. Com. Bordeaux* **28** (1902): 65–81. **Pawlowski.**

La Gironde et le Golfe de Gascogne au XVI^e siècle. Extraits du *Routier de la Mer* de Pierre Garcie, dit Ferrande, publiés et annotés par A. Pawlowski.

A note on the "routiers" of Garcie was given in the *Journal* for September, 1901 (p. 315).

France—Burgundy. *Ann. G.* **11** (1902): 43–53. **Girardin.**

Le relief des environs de Dijon et les principales formes topographiques de la Bourgogne. Par Paul Girardin. *With Map and Plates.*

France—Gascony. *Naturw. Wochenschrift* **1** (1902): 277–282, 292–295. **Engler.**

Aus den Dünen und Landes der Gascogne. Von Arnold Engler. *With Illustrations.*

France and England. *C. Rd.* **134** (1902): 786–788. **Ballore.**

Sur l'influence sismique des plissements armoricains dans le nord-ouest de la France et dans le sud de l'Angleterre. Note de M. F. de Montessus de Ballore.

Germany. *Vierteljahrshefte G. Unterricht* **1** (1902): 140–143. **Günther.**

Das Ries. (Eine geologisch-geographische Skizze nach Branco und Fraas.) Von Prof. Dr. S. Günther.

Germany. *Petermanns M.* **48** (1902): 38–40. **Hansen.**

Küstenänderungen in Rüstringen und Wangerland. Von Prof. Dr. R. Hansen. *With Map.*

Germany. **Kirchhoff and Hassert.**

Bericht über die neuere Litteratur zur deutschen Landeskunde. Herausgegeben im Auftrag der Zentralkommission für wissenschaftliche Landeskunde von Deutschland. Von Prof. Dr. Alfred Kirchhoff und Prof. Dr. Kurt Hassert. Band I. (1896–1899). Berlin: Alfred Schall, 1901. Size 11 × 8, pp. 254.

This publication is intended to supplement the *Bibliotheca Geographica Germaniæ* brought out under the auspices of the same body in 1896, by dealing with the literature which has appeared since that date. It differs from the former work in giving, not only the titles, but an indication of the contents of the several works, and will prove of much value to students in view of the large extent of modern literature on German geography.

Russia—Finland. *Fennia* **18** (1900–1901), No. 3: 1–10. **Neovius.**

La densité de la population en Finlande, d'après une méthode cartographique nouvelle. Par E. R. Neovius. *With Maps.*

Russia—Finland. *Fennia* **10** (1894–1901), No. 2: 1–242. ——

Katalog öfver trigonometriska och astronomiska punkter i södra Finland intill 61sta breddgraden bestämda åren 1860–1886 af Ryska Generalstabens Topografiska Afdelning. *With Map.*

Russia—Kola Peninsula. *Fennia* 16 (1900), No. 1: 1–151. **Ramsay.**
Ueber die Geologische Entwicklung der Halbinsel Kola in der Quartärzeit. Von Wilhelm Ramsay. *With Map and Plates.*

Spain—Mountain Structure. *C. Rd.* 134 (1902): 493–495. **Nicklès.**
Sur l'existence de phénomènes de recouvrement dans la zone subbétique. Note de M. René Nicklès.

Switzerland—Lake of Geneva. **Forel.**
F. A. Forel. Le Léman. Monographie Limnologique. Tome Troisième, Première livraison. Lausanne: F. Rouge, 1902. Size 10 × 6½, pp. 412. *Map and Illustrations.*

This part of Prof. Forel's great work treats of biology, the section dealing with the regional association of organisms being especially valuable from a geographical point of view. The second part of vol. 3 will deal with the historical, archæological, and economic aspects of the lake, and will complete the work.

Turkey. *Quarterly J. Geolog. S.* 58 (1902): 150–162. **English.**
Coal- and Petroleum-Deposits in European Turkey. By Lieut.-Colonel Thomas English. *With Map and Illustration.*

United Kingdom. *Geolog. Mag.* 9 (1902): 67–69. **Callaway.**
The Zigzag Course of the Cheddar Gorge. By Dr. C. Callaway. *With Diagram.*
See note in the April number (*ante*, p. 501).

United Kingdom—England. **Avebury.**
The Scenery of England and the Causes to which it is due. By the Right Hon. Lord Avebury. London: Macmillan & Co., 1902. Size 9 × 6, pp. xxvi. and 534. *Maps, Diagrams, and Illustrations. Price 15s. net. Presented by the Publishers.*

This will be the subject of a review.

United Kingdom—England. **Baddeley.**
Thorough Guide Series. Bath and Bristol and Forty Miles Round. London: Dulau & Co., 1902. Size 6½ × 4½, pp. xvi. and 268. *Maps and Plans. Price 5s. net. Presented by the Publishers.*

This is a valuable addition to the well-known series of 'Thorough Guides.' Although the district dealt with lacks, as a whole, the scenic interest of some of the more popular tourist resorts, it is, as the author remarks, a hardly-to-be-surpassed example of rich rural and characteristic English landscape, while the architectural monuments, to which full justice is done, give an additional interest to it. The excellent contoured maps by Bartholomew, one of which shows the Wye valley, are, as in other guides of the series, a valuable supplement to the descriptions.

United Kingdom—England. *Symons's Meteorolog. Mag.* 37 (1902): 1–4. ———
Dust Shower in the South-West of England. *With Map.*

The map shows all the places at which a deposit of dust was noticed in January.

United Kingdom—London. *G. Teacher* 1 (1902): 67–76. **Davies.**
The Geography of Greater London. By A. M. Davies. *With Maps.*

United Kingdom—Scotland. *Scottish G. Mag.* 18 (1902): 24–29. **Niven.**
On the Distribution of certain Forest Trees in Scotland, as shown by the Investigation of Post-Glacial Deposits. By Walter N. Niven. *With Map.*

United Kingdom—Scotland. *B.S.G. Lyon* 17 (1902): 545–559. **Privat-Deschanel.**
Les influences géographiques dans la Répartition de la Population en Écosse. Par M. Paul Privat-Deschanel.

United Kingdom—Wales. *Quarterly J. Geolog. S.* 58 (1902): 35–36. **Codrington.**
Note on a Submerged and Glaciated Rock-Valley recently exposed to view in Carmarthenshire. By Thomas Codrington. *With Section.*

Western Europe. *B.S.G. Com. Bordeaux* 28 (1902): 1–20. **Desbats.**
La mission de la Société d'océanographie en Espagne et en Portugal. Par Gabriel Desbats. *With Map and Illustrations.*

Also separate copy, entitled "Mission Océanographique dans le Golfe de Gascogne." Bordeaux, 1902.

The "Oceanographical Society of the Gulf of Gascony" was founded about two years ago for research on the meteorology, hydrology, and marine biology of the coasts of Western Europe. The voyage here described was carried out in 1900–1901.

ASIA.

Arabia—Farsan Islands. *Asien* 1 (1901): 31–33. **Plüddemann.**
Kohlenstationen und die Farisan-inseln. Von Kontre-Admiral Z. D. M. Plüddemann. *With Map.*

Aral Sea. *Zemlevedenie* 8 (1901): 1–28. **Berg.**
Sketch of the Physical Geography of the Aral Sea. By L. S. Berg. [In Russian.] *With Maps and Illustrations.*

See the note and map in the April *Journal* (p. 503).

Armenia. *Asien* 1 (1901–1902): 6–9, 27–31, 71–74. **Zimmerer.**
Armenien. Eine Kulturhistorische Studie. Von Prof. Dr. H. Zimmerer.

Asia. *G.Z.* 7 (1901): 609–625, 677–692. **Kürchhoff.**
Eisenbahnen und Eisenbahnpläne in Klein- und Mittel-Asien, Persien und Afghanistan. Von Oberleutnant a. D. Kürchhoff.

China. *P.R.G.S. Australasia, South Australian Br.* 4 (1901): 91–109. **Eitel.**
China and the Far Eastern Question. By Rev. Dr. Eitel.

China. *Vierteljahrshefte G. Unterricht* 1 (1902): 113–122. **Immanuel.**
Die Landschaft Kwantung (Südmandschurei) im russischen Besitze. Von Hauptmann Immanuel.

China. **Little.**
The Land of the Blue Gown. By Mrs. Archibald Little. Second Impression. London: T. Fisher Unwin, 1902. Size 9 × 6, pp. xx. and 370. *Illustrations. Price 21s. net. Presented by the Publishers.*

Mrs. Little's lively sketches of residence and travel in China, from the treaty ports to the far western interior, give an excellent insight into the life and characteristics, both of the Chinese themselves and of the European colonies. She shows herself a shrewd observer of men and manners, and her opinions carry weight from the impartial spirit which she has evidently brought to bear on her inquiries. In its external form the book shares the disadvantages attaching to so many modern books from the heavily loaded paper which publishers persist in using, to the great annoyance of their clients among the reading public.

China. *Questions Dipl. et Colon.* 13 (1902): 272–277. **Madrolle.**
La Navigation à vapeur dans le Se-tch'ouen. Par Cl. Madrolle. *With Map.*

China. **Reclus.**
Élisée et Onésime Reclus. L'Empire du Milieu. Le climat, le sol, les races, la richesse de la Chine. Paris: Hachette & Co., 1902. Size 9 × 7, pp. 668. *Maps and Illustrations. Presented by the Publishers.*

This is a companion volume to that on South Africa brought out last year. The authors have done good service by supplying an up-to-date compendium of the geography, climate, people, and resources of parts of the world on which so much attention is focused at present. The present volume is perhaps the most complete work of reference on China that has yet appeared. There are numerous sketch-maps, and a bibliography of the most important works on China which have appeared since 1882, from which, however, one or two are missing that we should have expected to find mentioned, *e.g.* M. Bonin's accounts of his two journeys across China.

China—Canton. **Ferguson.**
Indian Antiquary 30 (1901): 421–451, 467–491; 31 (1902): 10–32, 53–65.
Letters from Portuguese Captives in Canton, written in 1534 and 1536. With an introduction on Portuguese Intercourse with China in the First Half of the Sixteenth Century. By Donald Ferguson.

China—Kiauchou. *Globus* 81 (1902): 229–236. ——
Tsingtau und Kiautschou. (Ein Kulturbild aus Deutsch-China.) *With Illustrations.*

China—Macao. *B. Comité l'Asie Française* 2 (1902): 22–24. ——
L' " extension " de Macao. Par R. C. *With Map.*

Chinese Empire. **Krahmer.**
Petermanns M. 47 (1901): 90–94, 160–163, 182–187, 205–208, 237–239, 260–262.
Nachrichten von der Expedition P. K. Koslows. Von Gen. Krahmer.

Chinese Turkestan. **Stein.**

Preliminary Report on a Journey of Archæological and Topographical Exploration in Chinese Turkestan. By M. A. Stein. London: Printed by Eyre & Spottiswoode, 1901. Size 11½ × 9, pp. 78. *Plates.*

A sketch of the topographical work done by Mr. Stein was given in the *Journal* for April, 1901 (p. 409). The present report gives much interesting information on the antiquarian discoveries made by the author, the plates showing (besides general views of the sites) specimens of carvings, vases, manuscripts and other objects, the most remarkable being, perhaps, the colossal relievo-figures found at Rawak, which seem to date from the period of the so-called Græco-Buddhist art.

French Indo-China. **Padaran.**

B. Comité l'Asie Française 1 (1901): 185–191, 243–249, 282–290, 379–383; 2 (1902): 78–84.

Les Possibilités économiques de l'Indo-Chine. Par Pierre Padaran. *With Map.*

French Indo-China. *B. Comité l'Asie Française* 2 (1902): 17–22. **Xieng-La.**

Le Mékong voie de pénétration. Par Xieng-La.

French Indo-China—Darlac. ———

B. Comité l'Asie Francaise 2 (1902): 106-110.

Le Darlac, une province laotienne. Par C. M. *With Map.*

Malay Archipelago—Java and Sumatra. **Giesenhagen.**

Auf Java and Sumatra. Streifzüge and Forschungsreisen im Lande der Malaien. Von Dr. K. Giesenhagen. Leipzig: B. G. Teubner, 1902. Size 9½ × 7, pp. x. and 270. *Map and Illustrations. Price* 12*s*.

This will be noticed with other books on the Malay archipelago.

Malay Archipelago—Sumatra. **Kan.**

Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 270–284.

Die neuesten Fortschritte der Kenntnis von Sumatra. Von Prof. Dr. C. M. Kan.

Persia. **Adams.**

Persia by a Persian. Personal Experiences, Manners, Customs, Habits, Religious and Social Life in Persia. By Rev. Isaac Adams. 1900. Size 9 × 6, pp. 536. *Illustrations.*

Contains details on the customs and modes of life in Persia not to be found in ordinary books of travel, and of which no one but a native of the country could treat adequately.

Persia. **Stileman.**

The Subjects of the Shah. By the Rev. Charles Harvey Stileman, M.A. London: Church Missionary Society, 1902. Size 7½ × 5½, pp. viii. and 96. *Illustrations. Presented by the Author.*

Persia. *Zap. Imp. Russ. G.S.* (*Gen. G.*) 36 (1901): pp. 362. **Zarudnoï.**

Voyage en Perse Orientale. Par N. Zarudnoï. [In Russian.]

Persia—Susa. *Imp. and Asiatic Quarterly Rev.* 12 (1901): 330–356. **Boscawen.**

Explorations at Susa. By W. St. Chad Boscawen.

Persia and Turkey. *J.R. Asiatic S.* (1902): 49–74. **Le Strange.**

Description of Persia and Mesopotamia in the year 1340 A.D., from the Nuzhat-al-Kulub of Hand-Allah Mustawfi, with a summary of the contents of that work. By G. Le Strange. *With Map.*

Russia. *Mém. S. Imp. Russe G., Sec. G.* 31 No. 2 (1901): pp. 492. **Hiekisch.**

Catalogue des données hypsométriques de la Russie d'Asie et en partie des pays limitrophes. Par M. le Dr. C. Hiekisch. [In Russian.]

See note, *ante*, p. 634.

Russia—Caucasus. *B. Caucasian Museum* 1, No. 4 (1901): pp. 154. **Satunin.**

On the Mammals of the Steppes of the North-Eastern Caucasus. By K. A. Satunin. [Russian and German.] *With Maps.*

Russia—Siberia. **Aulagnon.**

La Sibérie Économique. Considérée plus spécialement dans sa partie Cisbaïkalienne. Par Claudius Aulagnon. Préface par M. Frédéric Passy. Paris: Guillaumin et Cie., 1901. Size 10 × 6½, pp. xii. and 232. *Illustrations. Price* 5*s*. 6*d*.

A useful study of the resources—mineral, vegetable, and animal—of Siberia, though

primarily written from the point of view of French trade. While decidedly sanguine as to the future of the country, the author seems to have arrived at his conclusions as a result of careful and impartial consideration.

Russia—Siberia. *J.R. United Service I.* 46 (1902): 18–38. **Bonar.**
From Japan to Europe by the Trans-Siberian Route. By H. A. Bonar. *Map.*
The journey was made in 1900 by the Amur and the railway.

Russia—Siberia. *Rev. G.* 50 (1902): 36–54. **Weulersse.**
Le Haut-Amour et la Chilka (Notes de voyage). Par Georges Weulersse.
The journey was made in August, 1900.

Russia—Siberian Railway. *B. Comité l'Asie Française* 1 (1901): 366–375. **Bidou.**
L'Achèvement du Transsibérien. Par Henry Bidou. *With Map.*

Siam. ——
Imp. and Asiatic Quarterly Rev. 11 (1901): 331–343; 12 (1901): 120–133.
A History of the French Missions to Siam. By "Pinya."

Turkey. *Missions Belges* 4 (1902): 12–27. **Lammens.**
Le chemin de fer de La Mecque et les musulmans indiens. Par Henri Lammens, S.J. *With Illustrations.*
On the project for a line from Damascus to Mecca.

Turkey—Asia Minor. *Deutsche Rundschau G.* 24 (1902): 211–218. **Borée.**
Hierapolis. Wort und Bild von W. Borée. *With Illustrations.*

Turkey—Asia Minor. *J. of T. Victoria I.* 33 (1901): 226–241. **White.**
A Visit to the Hittite Cities Eyuk and Boghaz. By Rev. G. E. White. *With Illustrations.*

Turkey—Asia Minor. *Globus* 81 (1902): 58–62. ——
Die Höhlenlandschaften Kappadoziens. *With Illustrations.*

Turkey—Kurdistan. *La G., B.S.G. Paris* 4 (1901): 393–402. **Galland.**
Dans le Kurdistan. Par P. Galland, O.P.

Turkey—Palestine. *J. of T. Victoria I.* 33 (1901): 242–252. **Wilson.**
Recent Investigations in Moab and Edom. By Major-General Sir Charles W. Wilson, K.C.M.G., etc.
On observations made during a tour in 1899.

Western Asia—Historical. **Belck.**
Beiträge zur alten Geographie und Geschichte Vorderasiens. Von Dr. Waldemar Belck. II. Leipzig: Eduard Pfeiffer, 1901. Size 9½ × 6½, pp. 57–112.
Contains notes on points connected with the early geography of Assyria and Armenia, on the Peutinger table, etc.

AFRICA.

Abyssinia. *M.G. Ges. Wien* 44 (1901): 291–311. **Bieber.**
Aitjôpija. Eine afrikanische Grossmacht und ihr Werden. Von Friedrich J. Bieber.

Abyssinia. **Powell-Cotton.**
A Sporting Trip through Abyssinia. A Narrative of a Nine Months' Journey from the Plains of the Hawash to the Snows of Simien, with a description of the Game, from Elephant to Ibex, and notes on the manners and customs of the natives. By P. H. G. Powell-Cotton. London: Rowland Ward, 1902. Size 9 × 6½, pp. xxiv. and 532. *Map and Illustrations. Price* 21s. *net. Presented by the Publisher.*

Mr. Powell-Cotton started from Zeila with the Harrison-Whitehouse Expedition, but soon after reaching Addis Abbaba decided to leave the party and make his way northwards through Abyssinia. The journey, described in the present work, was of some interest as leading through parts of the country but little visited by Englishmen within recent years. It is hardly correct, however, to say that it led "through regions which no European foot had trod for generations," and in the bibliography given in Appendix 4 we miss such names as D'Abbadie, Rohlfs, Heuglin, Cecchi and other Italians, to say nothing of less-known travellers. The work is by no means solely a record of sport, though this was the primary object of the journey.

Abyssinia—Gold. **Bruchhausen.**

Beiträge Kolonialpolitik 3 (1901–1902): 260–262.

Abessinien als Goldland. Von Major A. D. Karl von Bruchhausen.

Africa. **Sievers and Hahn.**

Afrika, Zweite Auflage, nach der von Prof. Dr. Wilhelm Sievers verfassten ersten Auflage umgearbeitet und erneuert von Prof. Dr. Friedrich Hahn. (Allgemeine Länderkunde . . . herausgegeben von Prof. Dr. Wilhelm Sievers. Zweite Auflage.) Leipzig und Wien: Bibliographisches Institut, 1901. Size 10½ × 7, pp. xii. and 682. *Maps and Illustrations. Presented by the Publishers.*

This useful work of reference has been entirely remodelled and brought up to date in the present edition.

Angola. *B.S.G. Lisboa* 18 (1900): 611–642. **Giraul.**

Idéas geraes sobre a colonização europeia da provincia de Angola. Pelo Visconde de Giraúl.

Azores. *XXVII. Jahresb. V. Erdk. Dresden* (1901): 145–180. **Ruge.**

Valentin Ferdinands Beschreibung der Azoren. Von S. Ruge.

The author of this manuscript account of the Azores was a German who came to Portugal at the end of the fifteenth century.

British East Africa. *J. S. Arts* 50 (1902): 229–241. **Whitehouse.**

To the Victoria Nyanza by the Uganda Railway. By Commander B. Whitehouse. *With Map.*

Notes on surveys on the shores of the Victoria Nyanza, and on the country traversed by the Uganda railway.

British West Africa. **George.**

The Rise of British West Africa, comprising the early history of the Colony of Sierra Leone, the Gambia, Lagos, Gold Coast, etc., etc. By Claude George. Part I. London: Houlston & Sons, 1902. Size 9 × 6, pp. 1–96. *Price* 2*s. Presented by the Publishers.*

This work, which is to be complete in five parts, is somewhat on the same lines as the West African volume of Lucas' 'Historical Geography of the British Colonies,' though entering more fully into details.

Cape Colony. Lovedale Mission. **Young.**

African Wastes Reclaimed. Illustrated in the story of the Lovedale Mission. By Robert Young. London: J. M. Dent & Co., 1902. Size 7½ × 5, pp. xii. and 268. *Portraits and Illustrations. Price* 4*s.* 6*d. net. Presented by the Publishers.*

The Lovedale Mission was founded early in the nineteenth century by the Glasgow Missionary Society, in the extreme east of Cape Colony, as it then was.

Central Africa. *Petermanns M.* 48 (1902): 12. **Langhans.**

Kupfer und Eisen in Marungu. Nach handschriftlichen Bemerkungen Weisser Väter. Von Prof. Paul Langhans. *With Map.*

Central Africa. *M. G. Ges. Hamburg* 17 (1901): 55–62. **Moisel.**

Begleitworte zu der karte "Dr. F. Stuhlmann's Aufnahmen im Gebiet des Albert- und Albert-Edward-Sees." Von Max Moisel. *With Map (2 Sheets).*

The map has already been noticed in the *Journal* (*ante*, p. 536).

Congo. **Droogmans.**

Notices sur le Bas-Congo. Annexes aux feuilles 1 à 15 de la Carte de l'État Indépendant du Congo à l'échelle du 100,000^e. Par Hubert Droogmans. Bruxelles: Imp. Vanbuggenhoudt, 1901. Size 11 × 7½, pp. xx. and 302. *Map. Presented by the Author.*

Accompanies the large scale-map of the lower Congo Region noticed in the *Journal* for December last. Much useful information is given for each sheet of the map in turn.

Congo State. *Mouvement G.* 19 (1902): 55–59. **Wauters.**

Le chemin de fer des Stanley-Falls. Par A. J. Wauters. *With Map.*

See note in the March number (p. 374).

Egypt. ——

Ministry of Public Works. A List of Publications, Maps, and Plans, published by the Public Works Ministry up to 31st December, 1901. Cairo, 1901. Size 9½ × 6½, pp. 32.

Egypt. *B. S. Khédiv. G.* 5 S. (1901): 619-625. **Boddy.**
Les sources de Moïse. Note d'Alexandre A. Boddy.

Egypt—Nubia. **Chantre.**
Les Barabra. Esquisse ethnographique et anthropométrique. Par Ernest Chantre. Lyon: A. Rey & Cie, 1901. Size 9 × 5½, pp. 20. *Illustrations.*

Madagascar. *Rev. Madagascar* 4 (1902): 34-54. **Grandidier.**
Histoire de la découverte de l'île de Madagascar par les Portugais (pendant le XVI^e siècle). Par Alfred Grandidier. *Also separate copy, presented by the Author.*

Madagascar. *J. of T. Victoria I.* 33 (1901): 334-361. **Shaw.**
The Arab Immigration into South-East Madagascar. By Rev. George A. Shaw.

Morocco. *Imp. and Asiatic Quarterly Rev.* 12 (1901): 306-329. **Montet**
A Special Mission to Morocco. By Prof. Dr. E. Montet.

Natal. **Anderson.**
Natal. Surveyor-General's Department. First Report of the Geological Survey of Natal and Zululand. By William Anderson. Pietermaritzburg, 1901. Size 12 × 8½, pp. 138. *Maps and Plates. Presented by the Surveyor-General of Natal.*

This will be specially noticed.

Nigeria. *J. African S.* 1 (1902): 160-173. **Mockler-Ferryman.**
British Nigeria. By Lieut.-Colonel A. F. Mockler-Ferryman. *Also separate copy presented by the Author.*

North-East Africa. *Rev. Française* 27 (1902): 129-146. **Demanche.**
Le chemin de fer français d'Éthiopie. Par G. Demanche. *With Map.*

North-East Africa. *Z. Ges. Erdk. Berlin* (1902): 7-32. **Neumann.**
Von der Somali-Küste durch Süd-Äthiopien zum Sudan. Von Oskar Neumann. *With Map and Illustrations.*

Portuguese West Africa—Angola. **Ravenstein.**
The Strange Adventures of Andrew Battell of Leigh, in Angola and the Adjoining Regions. Reprinted from 'Purchas His Pilgrimes.' Edited, with Notes and a Concise History of Kongo and Angola, by E. G. Ravenstein. London: Printed for the Hakluyt Society, 1901. Size 9 × 5½, pp. xx. and 210. *Presented by the Hakluyt Society.*

A notice of this appears elsewhere.

Rhodesia. **Hall and Neal.**
The Ancient Ruins of Rhodesia. (Monomotapæ Imperium.) By R. N. Hall and W. G. Neal. London: Methuen & Co., 1902. Size 9 × 6, pp. xxviii. and 396. *Maps, Plans, and Illustrations. Price 21s. net. Presented by the Publishers.*

This was reviewed in the April number of the *Journal.*

Sahara. *C. Rd.* 133 (1901): 1265-1266. **Deburaux.**
Sur un projet de traversée du Sahara par ballon non monté. Note de M. Deburaux.

As an experiment it is proposed to make the first attempt with an empty balloon, the aeronaut's place being taken by automatic apparatus.

Sahara. **Laquière.**
Renseignements Colon., Comité l'Afrique Française, No. 1 (1902): 1-35.
La Colonne Servière au Tidikelt, au Touat et au Gourara (21 mai—18 août 1900): le Carnet de route du commandant Laquière.
La deuxième reconnaissance du général Servière au Gourara et au Touat. Par le Commandant Laquière. *With Maps and Illustrations.*

South Africa. **Guyot.**
Yves Guyot. Les indigènes de l'Afrique du sud. Les Vaalpens. (Extrait des *Bulletins de la Société d'Anthropologie de Paris,* 5^e série, t. ii. fasc. 4, 1901.) Paris, 1901. Size 10 × 6½, pp. 16. *Presented by the Author.*

South Africa. *J. African S.* 1 (1902): 215-229. **Lacy.**
A Century of Exploration in South Africa. By George Lacy.

The writer shows a singular incapacity to gauge the relative importance of different explorations, and falls into error, besides, as to matters of fact, as is shown in a note by Mr. Selous which follows the paper.

South Africa. *J. African S.* 1 (1902): 174–183. **Peters.**
Ophir and Punt in South Africa. By Dr. Carl Peters. *With Illustrations.*

Dr. Peters' views have been refuted in Prof. Keane's recent work on Ophir.

South Africa. *T.S. African Philosoph. S.* 11 (1901): 189-206. **Sclater.**
Notes on the so-called "Post-Office Stone" and other inscribed stones preserved in the South African Museum and elsewhere. By W. L. Sclater.

On inscriptions dating from the early part of the seventeenth century recording visits of ships, etc.

Tanganyika. *Petermanns M.* 47 (1901): 275–278. **Stromer.**
Ist der Tanganyika ein Relikten-See? Von Dr. Ernst Stromer.

See note in the Monthly Record for April (p. 507).

West Africa. *Scottish G. Mag.* 18 (1902): 30–34. **Speak.**
The Gold-producing Region of West Africa. By S. J. Speak.

West Africa—Currency. *Globus* 81 (1902): 12–13. **Schurtz.**
Afrikanisches Steingeld. Von H. Schurtz. *With Illustrations.*

The small stone discs here referred to as lately discovered in the Gold Coast—Togo borderland—are said to have been used as currency before the introduction of cowries. The only known region where stone currency is actually in use is that of the Caroline islands.

West Africa—Flora. **Hiern.**
Catalogue of the African Plants collected by Dr. Friedrich Welwitsch in 1853–61. Part iv. Dicotyledons. Lentibulariaceæ to Ceratophylleæ. By William Philip Hiern. Pp. 785–1035. Vol. ii. part ii. Cryptogamia, pp. 261-565. London: 1900–1901. Size 8½ × 5½. *Presented by the Trustees of the British Museum.*

The four parts dealing with the Dicotyledons are regarded as vol. i., which is now complete, as is also vol. ii., which contains a general index to the whole.

West Africa—Historical. *Verh. Naturforsch. Ges. Basel* 13 (1901): 1-141. **Henning.**
Samuel Braun aus Basel der erste deutsche wissenschaftliche Afrikareisende. Beitrag zur Erforschungsgeschichte von Westafrika. Von Dr. Georg Henning. *With Map.*

This German traveller visited the whole Guinea Coast, in the years 1610–20, and wrote an account of his travels, which was published at Basel in 1624.

West Africa—Historical. **Mees.**
Dr. Jules Mees. Les Manuscrits de la "Chronica do descobrimento e conquista de Guiné" par Gomes Eannes de Azurara, et les sources de João de Barros. Lisboa: Livraria Ferin. Size 10 × 6½, pp. 14.

West Africa—San Thomé. *B.S.G. Italiana* 3 (1902): 40–59. **Fea.**
San Thomé. Del Leonardo Fea.

NORTH AMERICA.

Alaska. *B.S.R. Belge G.* 25 (1901): 389-409. **Pasteyns.**
Alaska. Par Fr. Pasteyns.

A compilation from published works.

Alaska—Copper River. *T. and P.G.S. Pacific* Ser. ii. 1 (1902): 45–50. **Davidson.**
The Copper River of Alaska. By George Davidson.

On the history of the name "Atna" as applied to the Copper river. It dates from the journey of the trader Nagáef in 1781.

Alaska and Canadian. *J. Franklin I.* 153 (1902): 161-192. **Balch.**
The Alasko-Canadian Frontier. By T. W. Balch. *With Maps.*

The writer describes in detail the Anglo-Russian negotiations in the early part of the nineteenth century leading up to the agreement of 1825, and reproduces various documents and maps. He holds that until the last few years the boundary claimed by the United States was universally accepted by English authorities.

Canada—British Columbia. *J.R. Colonial I.* 33 (1902): 204–225. **Turner.**
British Columbia of To-day. By Hon. J. H. Turner.

Canada—Labrador. **Daly.**
B. Museum Comparative Zoology Harvard College **38** (1902): 205–270.
The Geology of the North-East Coast of Labrador. By Reginald A. Daly. *With Maps and Plates.*

A note on this paper will be given.

Canada—Red River Valley. **Dowling.**
The Physical Geography of the Red River Valley. By D. B. Dowling. (Reprinted from the *Ottawa Naturalist*, vol. xv. No. 5, pp. 115–120, August, 1901.) Size 9 × 6. *Maps.*

Mexico. *B.S. d'Études Colon.* **9** (1902): 1–16. **Buttgenbach.**
Le nord-ouest du Mexique. Par H. Buttgenbach. *With Illustrations.*

Mexico. *National G. Mag.* **13** (1902): 1–24. **Foster.**
The New Mexico. By John W. Foster. *With Maps and Illustrations.*

Mexico. *J.G.* **1** (1902): 6–17. **Marshall.**
Useful Products of the Century Plant. A Lesson on Mexico. By William B. Marshall. *With Illustrations.*

On the species of *Agave* which produces "Sisal" hemp.

Mexico. *G.Z.* **7** (1901): 697–699. **Deckert.**
Die Territoral- und Bevölkerungsverhältnisse der mexikanischen Republik nach dem Census von 1900. Von Dr. E. Deckert.

Mexico—Lighthouses. ——
Estado de la Iluminacion y Avalizamiento en las Costas de los Estados Unidos Mexicanos en 31 de Diciembre de 1901. Mexico, 1902. Size 13½ × 9, pp. 30. *Charts and Illustrations. Presented by Mr. Henry A. Case.*

North and Central America. **Ridgway.**
B. United States Nat. Museum, No. 50 (1901): pp. xxx. and 716.
The Birds of North and Middle America. By Robert Ridgway. Part i. Family Fringillidæ—The Finches. *With Plates.*

North-west Coast. **Davidson.**
The Tracks and Landfalls of Bering and Chirikof on the North-west Coast of America from the point of their separation in lat. 49° 10′, long. 176° 40′ W., to their return to the same meridian. June, July, August, September, October, 1741. George Davidson (Private Publication), 1901. Size 10½ × 7, pp. 44. *Map.*

This is noticed elsewhere (p. 756, *ante*).

United States. *Deutsche Rundschau G.* **24** (1901): 123–127. **Blum.**
Die Entwickelung der Vereinigten Staaten von Amerika. Statistische Zusammenstellungen nach den Censusberichten der Regierung der Vereinigten Staaten, die Volkszählung von 1900 betreffend. Von Richard Blum.

United States. *J. Geology* **9** (1901): 718–731. **Salisbury.**
Glacial Work in the Western Mountains in 1901. By Rollin D. Salisbury.

United States. **Royce.**
Eighteenth Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution, 1896–97. By J. W. Powell, Director. In two parts. Part 2. Indian Land Cessions in the United States. Compiled by Charles C. Royce. Washington, 1899. Size 11½ × 8, pp. 521–997.

Contains a large amount of information bearing on the history of settlement in the United States. The bulk of the work is an enumeration of all the cessions of land by, or reservations for, Indian tribes from 1784 onwards, while the 67 maps show the extent of the individual cessions, etc.

United States—Arkansas. *J. Geology* **9** (1901): 694–701. **Purdue.**
Physiography of the Boston Mountains, Arkansas. By A. H. Purdue. *With Map and Section.*

United States—California. *Sierra Club B.* **4** (1902): 25–34. **Eells.**
In Tuolumne and Cathedral Cañons. By Alexander G. Eells. *With Plate.*

United States—Cascade Range. *Science* **15** (1902): 203–211. **Diller.**
The Wreck of Mt. Mazama. By J. S. Diller.

United States—Mississippi River. *J. School G.* **5** (1901): 379-382. **Davis.**

Maps of the Mississippi River. By Wm. Davis.

The author gives instances of the geographical facts illustrated by the maps of the "Mississippi River Commission," which are held to be the most valuable ever issued for a river of the first magnitude.

United States—Smithsonian Institution. **Rhees.**

Smithsonian Miscellaneous Collections. Vol. xliii. The Smithsonian Institution. Documents Relative to its Origin and History, 1835-1899. Compiled and edited by William Jones Rhees. In two volumes. Vol. ii. 1887-1899. Fiftieth Congress to Fifty-fifth Congress. Washington, 1901. Size 9½ × 6, pp. xvi. and 1045-1983. *Plans. Presented by the Smithsonian Institution.*

CENTRAL AND SOUTH AMERICA.

Bolivia—Cochabamba. **Blanco.**

Diccionario Geográfico de la República de Bolivia, Tomo Segundo, Departamento de Cochabamba. Por Federico Blanco, con adiciones de P. Aniceto Blanco y Manuel V. Ballivián. La Paz, 1901. Size 10½ × 7¼, pp. xii. and 176. *Plan.*

Brazil. *Meteorolog. Z.* **19** (1902): 108-119. **Draenert.**

Das Klima von Juiz de Fora im Staate Minas-Geraes. Von Prof. F. M. Draenert.

Brazil—São Paulo. ———

Export **23** (1901): 635, 648-649, 663-665, 676-678; **24** (1902): 9.

Das Flussgebiet der Ribeira im Staate São Paulo. (Originalbericht aus São Paulo.)

Central America. **Sapper.**

Mittelamerikanische Reisen und Studien aus den Jahren 1888 bis 1900. Von Dr. Karl Sapper. Braunschweig: F. Vieweg & Son, 1902. Size 9½ × 6½, pp. xiv. and 426. *Maps and Illustrations. Price* 10m. *Presented by the Publishers.*

This will be reviewed elsewhere in the *Journal.*

Central America—Canal. *National G. Mag.* **13** (1902): 64-70. ———

The Latest Route proposed for the Isthmian Canal—Mandingo Route. *With Map and Profile.*

This route in question takes a straight course (without locks) of only 29½ miles between the Gulf of San Blas and the Bay of Panama, as compared with 49·9 miles by the Panama route, but involves a tunnel of 5 miles.

Chile. ———

Anuario hidrografico de la Marina de Chile. Tomo 23. Valparaiso, 1901. Size 10½ × 7, pp. 562. *Charts and Illustrations.*

The first section gives an account of various hydrographic surveys on the coasts of Chile, with some information on the fauna, flora, and geology.

Chile. *Scottish G. Mag.* **18** (1902): 14-24. **Gormaz.**

Depressions and Elevations of the Southern Archipelagoes of Chile. By Francisco Vidal Gomaz. *With Map.*

Chile and Argentina. *Scottish G. Mag.* **18** (1902): 87-90. **Gibson.**

The Boundary Dispute between Chile and Argentina. By Hope Gibson.

Guatemala. **Seler.**

Wissenschaftliche Ergebnisse einer . . . Reise durch Mexico und Guatemala. I. Die alten Ansiedelungen von Chaculá im Distrikte Nenton des Departements Huehuetenango der Republik Guatemala. Von Dr. Eduard Seler. Berlin: Dietrich Reimer (Ernst Vohsen), 1901. Size 13 × 10, pp. xviii. and 224. *Maps and Illustrations. Presented by the Publishers.*

This is the first part published of the archæological results of Prof. Seler's important researches in Central America, the popular account of which was reviewed in the *Journal* for February 1901. It is produced in first-rate style.

Guatemala. *M.G. Ges. Hamburg* **17** (1901): 78-224. **Sapper.**

Die Alta Verapaz (Guatemala). Eine landeskundliche Skizze. Von Dr. Karl Sapper. *With Maps.*

A detailed account of one of the most interesting districts of Guatemala, in which many Germans have started plantations of late years.

Guiana. *Rev. Colon.* 1 (1901): 160–185. **Guffroy.**
Note sur les peuples autochtones des Guyanes et sur les tribus noires du Maroni et de ses affluents, l'Awa et le Tapanahoni. Par M. Guffroy.

Jamaica. **Roxburgh and Ford.**
The Handbook of Jamaica for 1902, comprising Historical, Statistical, and General Information concerning the Island. Compiled by T. L. Roxburgh and Jos. C. Ford. London: E. Stanford, 1902. Size 8½ × 5½, pp. viii. and 524. *Map. Price 7s. 6d. Presented by the Publishers.*

Jamaica. *J.S. Arts* 50 (1902): 213–224. **Thomas.**
Jamaica. By Herbert T. Thomas.

Panama Canal. *Tour du Monde* 8 (1902): 1–12. **Bel.**
L'Isthme de Panama et le Canal Interocéanique. Par M. Raymond Bel. *With Map and Illustrations.*

Patagonia. *K. Svensk. Vetens.-A. Handlingar* 33 (1900): No. 3, pp. 24. **Nordenskiöld.**
Iakttagelser och fynd i grottor vid Ultima Esperanza i Sydvestra Patagonien. Af Erland Nordenskiöld. *With Plates.*

Peru. *B.S.G. Lima* 10 (1900-1901): 338–354; 423–441. **Clément**
Revisión del arco meridiano del Perú. Por el Coronel Pablo Clément. *With Diagram.*

Peru. *B.S.G. Lima* 10 (1900-1901): 243-312; 380–422; 11 (1901): 1–62. **Raimondi.**
Itinerario de los Viajes de Raimondi en el Peru. De Tayabamba á Carhuaz (1860). —Provincias de Huaylas, Huaraz, Huari y Huamalies (1860).—Pátapo, Pucalá, Chongoyape, Huando, Montán, Chota Hualgayoc, Cajamarca, Magdalena, San Pablo, San Miguel, Mina de Cushuro y pueblo de Niepos (1868).—De Niepos á Saña y regreso á Lambayeque (1868).

Peru and Bolivia. *B.S.G. Lima* 10 (1901): 445–482. **Polo.**
Indios Uros del Perú y Bolivia. Por José Toribio Polo. *Also separate copy, presented by the Author.*

Peru and Chile—Tacna. **Maurtua and Pezet.**
The Question of the Pacific. An Edition in English of the Work of Dr. Victor M. Maurtua. Enlarged and brought up to date, with Map of Disputed Territory, by F. A. Pezet. Philadelphia: G. F. Lasher, 1901. Size 9½ × 6½, pp. vi. and 312. *Map. Presented by Señor F. A. Pezet.*

Dr. Maurtua's work, lately published in Peru, has been extended by the translator with a view to presenting English readers, especially in the United States, with a comprehensive and accurate statement of the territorial question still in dispute between Chili and Peru. It goes back to the early political geography of the region in question, and traces the whole course of events which have led to the present difficulty. The clearly drawn map is on the scale of 1 : 750,000.

West Indies—Jamaica. **Rhodes.**
Jamaica and the Imperial Direct West India Mail Service. By Thomas Rhodes. London: S. Philip & Son. 1901. Size 6 × 10, pp. 44. *Map and Illustrations. Price 6d. net. Presented by the Publishers.*

The writer insists on the great natural resources of Jamaica, and urges the advantages of the island as the goal of a sea-trip.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Aborigines. **Matthews.**
P.R.G.S. Australasia, South Australian Br. 4 (1901): 43–52.
Native Tribes of the Upper Murray. By Daniel Matthews.

Australia and Pacific. **Daiber.**
Eine Australien und Südseefahrt von Dr. Albert Daiber. Leipzig: B. S. Teubner, 1902. Size 9½ × 6½, pp. viii. and 320. *Map and Illustrations. Price 7s.*

An account of Australia for the benefit of German readers, who, the author thinks, possess very inadequate sources of information on many important questions relating to that country. Besides notes gathered by the author himself during his travels, it includes a more general discussion of the main physical, social, and economic features of Australia.

British New Guinea. **Le Hunte.**
British New Guinea. Report for 1899-1900. Colonial Reports, Annual No. 336, 1901. Size 9½ × 6, pp. 52. *Price 3d.*

Caroline Islands. *M.G. Ges. Hamburg* 17 (1901): 1-27. **Friederichsen.**
Die Karolinen. Von Dr. Max Friederichsen.

An excellent summary of our knowledge of the geography and natives of the Carolines.

Caroline and Marianne Islands. **Volkens.**
Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 167-179.
Einige Ergebnisse einer Reise nach den Karolinen und Marianen. Von Prof. Dr. G. Volkens.

Attention is directed principally to the climate and vegetation of the islands, especially Yap.

Kerguelen Island. *Z. Ges. Erdk. Berlin* (1902): 61-65. **Schlüter.**
Ueber die Aussprache des namens Kerguelen. Von Dr. O. Schlüter.

The writer shows that the proper pronunciation of the name is Kergellen. The word is Breton, and means "House of the *Kelen*," or *Ilex aquifolia*.

New South Wales. **Coghlan.**
Picturesque New South Wales: an Illustrated Guide for Settler and Tourist. Prepared under the direction of T. A. Coghlan. Sydney, 1901. Size 10 × 7½, pp. iv. and 124. *Illustrations. Presented by the Agent-General for New South Wales.*

New South Wales. ——
Annual Report of the Department of Mines, New South Wales, for the year 1900. Sydney, 1901. Size 13 × 8½, pp. iv. and 218. *Plans and Illustrations.*

New South Wales. **Eyre.**
P.R.G.S. Australasia, South Australian Br. 4 (1901): 127-145.
Exploration in New South Wales in 1844. Letters from E. J. Eyre and enclosures thereto.

New Zealand. *T. and P. New Zealand I.* 33 (1900): 467-471. **Best.**
Maori Origins. Part ii. By Elsdon Best.

New Zealand. *T. and P. New Zealand I.* 33 (1900): 499-514. **Morris.**
On the Tracks of Captain Cook. By Prof. E. E. Morris.

Describes a visit to portions of the New Zealand coast first touched at by Cook.

New Zealand. *T. and P. New Zealand I.* 33 (1900): 335-336. **Page.**
Notes on an Artesian-well system at the Base of the Port Hills. By S. Page, with Analyses by E. B. R. Prideaux.

New Zealand. *T. and P. New Zealand I.* 33 (1900): 445-467. **Segar.**
The Population of New Zealand. By H. W. Segar.

New Zealand. *T. and P. New Zealand I.* 33 (1900): 313-323. **Thomson.**
Plant-acclimatisation in New Zealand. By George M. Thomson.

New Zealand—Year Book. **Dadelszen**
The New Zealand Official Year-Book, 1901. Prepared by E. J. von Dadelszen. Wellington: J. Mackay, 1901. Size 8½ × 5½, pp. vi. and 640. *Map, Diagrams, and Illustrations.*

Pacific. **Colquhoun.**
The Mastery of the Pacific. By Archibald R. Colquhoun. London: W. Heinemann, 1902. Size 10 × 6, pp. xvi. and 416. *Maps and Illustrations. Price 18s. net.*

Mr. Colquhoun, who has recently extended his previous wide acquaintance with the Far East by a tour in the Pacific, presents in this work an account of the conditions now prevailing in the spheres of the various powers in that ocean, which he regards as the scene of the great struggle of the twentieth century, where the future of more than one Great Power will be decided. It will prove valuable as directing attention to an important subject, and assisting the reader to forecast for himself the probable trend of future events. This map is incomplete as regards the Pacific steamship routes.

Queensland. **Cameron.**
Report on the Etheridge and Gilbert Gold Fields. By Walter E. Cameron, B.A. Brisbane, 1900. Size 13½ × 8½, pp. 16. *Maps and Sections.*

Queensland. **Cameron.**
Report on Recent Developments in the Copper-Mining Industry in the Cloncurry District. By Walter E. Cameron, B.A. Brisbane, 1900. Size 13½ × 8½, pp. 10. *Map and Plans.*

Queensland. *B. Geolog. Surv. Queensland*, No. 17 (1901): pp. 16. **Dunstan.**
Report on the Geological Features of Hazledean, west of Mackay; with Notes on the Coal, Limestone, and other Mineral Products of the Mackay District. By B. Dunstan. *With Map and Sections.*

Samoa, etc. **Hesse-Wartegg.**
Samoa, Bismarckarchipel und Neuguinea. Drei deutsche Kolonien in der Südsee. Von Ernst von Hesse-Wartegg. Leipzig: J. J. Weber, 1902. Size 10 × 7, pp. viii. and 330. *Maps and Illustrations. Price* 15*s.*

A well-illustrated popular account of a visit to the German South-sea colonies. The author has a good deal to tell of the inhabitants and general condition of those colonies, some of the places visited, *e.g.* the St. Matthias islands, being off the beaten track.

Solomon Islands. **Amherst and Thomson.**
The Discovery of the Solomon Islands by Alvaro de Mendaña in 1568. Translated from the original Spanish Manuscripts. Edited, with Introduction and Notes, by Lord Amherst of Hackney, and Basil Thomson. 2 vols. London: Printed for the Hakluyt Society, 1901. Size 9 × 6, pp. lxxxvi. and 482. *Maps and Plates. Presented by the Hakluyt Society. Also large paper copy, presented by the Authors.*

A collection of original authorities on Mendaña's voyage, including the MSS of Catoira, preserved in the British Museum, and of Gallego, now in the possession of Lord Amherst of Hackney, translations of both of which are published for the first time.

South Australia—Northern Territory. **[White.]**
Mission Field 46 (1901): 401–405; 47 (1902): 46–50.
The Diocese of Carpentaria. By the Bishop. *With Map and Illustrations.*
The Bishop of Carpentaria's Journey. *With Map.*

Western Australia. *Scottish G. Mag.* 18 (1902): 1–13. **Macdonald.**
Across the Westralian Desert. By Alexander Macdonald.

Western Australia. ——
The Land Selections' Guide to the Crown Lands of Western Australia. Perth, 1901. Size 8½ × 5½, pp. 66. *Maps and Illustrations. Presented by the Minister for Lands, W. Australia.*

Western Australia. ——
Western Australia and its Resources. Perth [*not dated*]. Size 8½ × 5½, pp. 136. *Maps and Illustrations.*

POLAR REGIONS.

Antarctic—Belgian Expedition. **Gerlache.**
Voyage de la *Belgica*. Quinze Mois dans l'Antarctique. Par le Commandant de Gerlache. Préface par Élisée Reclus. Deuxième Édition. Paris: Hachette & Cie., 1902. Size 10 × 6½, pp. vi. and 292. *Map and Illustrations. Presented by the Publishers.*

An extension of the series of articles which appeared last year in the *Tour du Monde*. A notice will be given elsewhere.

Antarctic—German Expedition. *Petermanns M.* 48 (1902): 40–44. **Drygalski.**
Die deutsche Südpolar-Expedition. Zweiter Bericht von Prof. Dr. E. v. Drygalski.

Antarctic—Meteorology. **Arçtowski.**
Expédition Antarctique Belge. Résultats du Voyage du S.Y. Belgica en 1897–1898–1899 sous le Commandement de A. de Gerlache de Gomery. Rapports scientifiques. Météorologie, Aurores australes. Par Henryk Arçtowski Anvers:

Imp. J.-E. Buschmann, 1901. Size 13½ × 11, pp. 64. *Illustrations. Presented by the Author.*

The scientific results of the voyage of the *Belgica* will be reviewed on the completion of publication.

Arctic. **Abruzzi.**

Farther North than Nansen; being the Voyage of the *Polar Star*. By H.R.H. The Duke of the Abruzzi. London: H. W. Bell, 1901. Size 10½ × 6½, pp. 98. *Illustrations. Presented by the Publishers.*

Translation of the addresses delivered by the Duke of the Abruzzi and Commander Cagni, before the Italian Geographical Society, and published in the *Bolletino* for February, 1901.

Arctic. **Amundsen.**

Kaptein Roald Amundsen: En paatoenkt Undersøgelsesreise til den magnetiske Nordpol. Foredrag den 25 de November, 1901. Size 9½ × 6½, pp. 12. *Map.*

A translation of this paper was given in the April *Journal* (p. 484).

Arctic—Phytogeography. *G.Z.* 8 (1902): 1–23. **Andersson.**

Zur Pflanzengeographie der Arktis. Von Dr. Gunnar Andersson. *With Maps and Illustrations.*

Arctic—Pilot. **Maclear.**

Arctic Pilot. Vol. ii. Sailing directions for Færoe Islands, Iceland, Greenland Sea, Spitzbergen, and the East Coast of Greenland. Compiled by Vice-Admiral J. P. Maclear. London: J. D. Potter, 1901. Size 9½ × 6, pp. xxii. and 264. *Index Map. Price 4s. Presented by the Hydrographer, Admiralty.*

Compiled from the accounts of all the chief arctic navigators. The first chapter includes, in addition to information on the climate, ice, currents, etc., of the Acrtic ocean, a geographical and general description of the arctic lands from the Færoes to East Greenland.

Arctic—Wellman Expedition. *M.K.K.G. Ges. Wien* 44 (1901): 177–184. **Brosch.**

Die Wellman'sche Polar-Expedition 1898–99, nach dem Kaiser-Franz-Josefs-Land. Von K. u. K. Contre-Admiral Gustav Ritter v. Brosch. *With Maps.*

Greenland. *Verh. Ges. Erdk. Berlin* 28 (1901): 475–481. **Amdrup.**

Herr Oberleutnant zur See Amdrup: Die Dänischen Expeditionen nach Ost-Grönland in den Jahren 1898–1899 und 1900. *With Map.*

Greenland. *Verh. Ges. Erdk. Berlin* 28 (1901): 482–485. **Hartz.**

Herr Dr. N. Hartz: Die Schiffsreise der Dänischen Expedition nach Ost-Grönland im Jahr 1900.

Ice Navigation. *Mem. Hydrography* 23 (1901): 192–217. **Islyamoff.**

Experimental Trip of "Yermak" in 1899. By I. Islyamoff. [In Russian.] *With Illustrations.*

Polar Regions—Magnetism. **Neumayer.**

Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 54–59.

Die Ergebnisse neuerer erdmagnetischer Beobachtungen in den Polar-Regionen. Von Prof. Dr. G. v. Neumayer.

MATHEMATICAL GEOGRAPHY.

Astronomy. **Penrose.**

On a method of predicting by Graphical Construction Occultations of Stars by the Moon and Solar Eclipses for any given place; together with more rigorous methods of reduction for the accurate calculation of longitude. By Francis Cranmer Penrose. Second Edition. London: Macmillan & Co., 1902. Size 15½ × 10, pp. x. and 42. *Diagrams. Price 12s. net. Presented by the Author.*

Determination of Positions. *Z. Ges. Erdk. Berlin* 36 (1901): 255–276. **Marcuse.**

Die neuere Entwickelung der geographischen Ortsbestimmung. Von Privatdocent Dr. Adolf Marcuse. *With Plate.*

Geodesy. *Rev. Scientifique* 17 (1902): 161–169. **Laussedat.**

Les progrès de la géodésie. Par A. Laussedat. *With Illustration.*

Geodesy. **Orff.**

Ueber die Hülfsmittel, Methoden und Resultate der Internationalen Erdmessung.

Festrede gehalten in der öffentlichen Sitzung der k. b. Akademie der Wissenschaften zu München am 15 November, 1899. Von Dr. phil. Karl v. Orff. München, 1899. Size 11 × 8½, pp. 60. *Presented by the Academy.*

Latitudes and Longitudes. ———

Accessions (No. VI.) to Collection of Latitudes and Longitudes. Map Room, Intelligence Division, W.O., December, 1901. Size 12½ × 10, pp. iv. and 54.

With the exception of six in China and one in British Guiana, all these positions refer to Africa.

Longitude Determination. *C. Rd.* **134** (1902): 387–389. **Lippmann.**

Appareil pour mesurer les différences de longitude à l'aide de la photographie. Note de M. G. Lippmann.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Dust-rain. *Abh. K. Preuss. Meteorolog. I.* **2** (1901): 1–93. **Hellmann and Meinardus.**

Der grosse Staubfall vom 9. bis 12. März, 1901, in Nordafrika, Süd- und Mitteleuropa. Von G. Hellmann und W. Meinardus. *With Maps.*

The fall has been found to have extended from Southern Algeria to Southern Denmark, over a land area of 300,000 square miles. This was not continuous, but was broken by tracts in which no fall was observed.

Geophysics. *XXVII. Jahresb. V. Erdk. Dresden* (1901): 105–124. **Reibisch.**

Ein Gestaltungsprincips der Erde. Von Paul Reibisch.

The author discusses the effects of a differential movement of the surface with respect to the poles on the elevation and depression of different parts of the surface.

Glaciers. **Finsterwalder.**

Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 180–182.

Die Erscheinungen, welche einem Gletschervorstoss vorausgehen. Von Prof. Dr. S. Finsterwalder.

Glaciers. *Verh. Dreizehnten Deutsch. Geographentages Breslau* (1901): 183–187. **Meyer.**

Ein Beitrag zur Gletscherkunde der Tropen. Von Prof. Dr. Hans Meyer.

Ice. *P.R.S.* **69** (1902): 429–424. **Vincent.**

The Density and Coefficient of Cubical Expansion of Ice. By J. H. Vincent, D.SC. (Abstract.)

Land-areas. *G.Z.* **7** (1901): 665–676. **Simroth.**

Ueber das Problem früheren Landzusammenhangs auf der südlichen Erdhälfte. Von Dr. H. Simroth. *With Map.*

Limnology. **Halbfass.**

Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 248–261.

Die wissenschaftliche und wirtschaftliche Bedeutung limnologischer Landesanstalten. Von Dr. W. Halbfass. *Also separate copy, presented by the Author.*

Meteorology. *Monthly Weather Rev.* **29** (1901): 408–418. **Kimball.**

The General Circulation of the Atmosphere, especially in Arctic Regions. By H. H. Kimball.

Meteorology. *Monthly Weather Rev.* **29** (1901): 545–546. **Balch.**

Evaporation Underground. By E. S. Balch.

The writer holds that we have yet absolutely no proof that subterranean ice (cf. *Journal*, vol. xix. p. 220) is ever produced by evaporation.

Meteorology—Auroras. *C. Rd.* **134** (1902): 93–95. **Stassano.**

De l'influence des basses pressions barométriques sur la fréquence des aurores polaires. Note de M. H. Stassano.

Mirage. *Ann. Hydrographiques* **2** S. (1901): 34–35. **Hervé.**

Note sur des observations de mirage faites à bord du croiseur *Chasseloup-Laubat*, le 27 mai 1901. Par M. Hervé. *With Illustrations.*

Mountains. *Scottish G. Mag.* **18** (1902): 76–84. **Geikie.**

Mountains. By Prof. James Geikie, F.R.S. II. *With Diagrams.*

Nautical Almanac. ———

The Nautical Almanac and Astronomical Ephemeris for the year 1905, for the meridian of the Royal Observatory at Greenwich. Edinburgh (not dated). Size 9 × 6, pp. 652 and 18. *Diagrams. Price 2s. 6d. Presented by the Admiralty.*

Part I. is also issued separately, *price 1s.*

Ocean Currents. **Russell.**
Current Papers, No. 5. By H. C. Russell, B.A., C.M.G., etc. (Read before the Royal Society of N. S. Wales, November 7, 1900) Size 9 × 5½, pp. 12. *Diagrams.*

Oceanography. *M.K.K.G. Ges. Wien* **44** (1901): 189–195. **Fuchs.**
J. Luksch's Untersuchungen über die Transparenz und Farbe des Meerwassers. Von Prof. Theodor Fuchs.

Oceanography. *Ciel et Terre* **22** (1901): 481–492. **Thoulet.**
La transparence et la couleur de la mer. Par J. Thoulet.

Oceanography. *C. Rd.* **134** (1902): 496–498. **Thoulet.**
Sur la constitution du sol subocéanique. Note de M. J. Thoulet.

Oceanography. *A travers le Monde, Tour du Monde* **8** (1902): 53–55. ———
Les plus grandes profondeurs de la Mer.

Oceanography—Fauna. *M.K.K.G. Ges. Wien* **44** (1901): 185–188. **Fuchs.**
Ueber das im Gefolge heftiger Stürme beobachtete Auftreten pelagischer Tiefseethiere an der Oberfläche des Meeres. Von Theodor Fuchs.

Oceanography—North Atlantic. **Peake and Murray.**
On the Results of a Deep-sea Sounding Expedition in the North Atlantic during the Summer of 1899. By R. E. Peake. With Notes on the Temperature Observations and Depths, and a Description of the Deep-sea Deposits in this Area. By Sir John Murray, K.C.B., etc. London: John Murray, 1901. Size 9½ × 6½, pp. 44. *Charts. Price* (to Fellows) 2*s.* 6*d. net;* (to non-Fellows) 5*s. net.*

One of the extra publications of the R.G.S. The soundings were taken by the *Britannia*, (1) in the vicinity of the Azores; (2) between the Azores and North America; (3) between the Azores and the British Isles. The large map shows the distribution of marine deposits, embodying the results obtained by the *Britannia.*

Oceanography—Plankton. **Cleve.**
K. Svensk. Vetens.-A. Handlingar **34** (1901): Nos. 1–3, pp. 22, 77, 22.

Notes on some Atlantic Plankton-organisms. By P. T. Cleve. *With Plates.*

The Plankton of the North Sea, the English Channel, and the Skagerack in 1899. By the same.

Report on the Plankton collected by the Swedish Expedition to Greenland in 1899. By the same.

Underground Waters. *C. Rd.* **134** (1902): 129–132. **Fournier.**
Sur la structure des réseaux hydrographiques souterrains dans les régions calcaires. Note de M. E. Fournier. *With Sketch-map.*

Zoogeography. *Naturw. Wochenschrift* **1** (1901): 97–100, 117–118. **Martens**
Ueber die Abgrenzung Zoogeographischer Reiche. Von Prof. E. v. Martens.

Zoogeography. *C. Rd.* **134** (1902): 115–117. **Vaney and Conte.**
Sur la distribution géographique et l'adaptation aux eaux douces de quelques formes marines. Note de MM. C. Vaney et A. Conte.

Zoogeography—Mosquitoes. **Theobald.**
A Monograph of the Culicidæ, or Mosquitoes, mainly compiled from the Collections received at the British Museum from various parts of the world, in connection with the investigation into the cause of Malaria, conducted by the Colonial Office and the Royal Society. By Fred V. Theobald. Two vols. and *Plates.* London: 1901. Size 8½ × 5½, pp. (vol. i.) xviii. and 424, (vol. ii.) viii. and 392. *Presented by the Trustees of the British Museum.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Agriculture. *Z. Ges. Erdk. Berlin* **36** (1901): 230–254. **Hahn.**
Ursprungsgebiet und Entstehungsweise des Ackerbaues. Von Dr. Eduard Hahn.

Anthropogeography. *Ann. G.* **11** (1902): 13–23. **De la Blache.**
Les conditions géographiques des faits sociaux. Par P. Vidal de la Blache.

Anthropogeography. *Popular Sci. Monthly* **60** (1902): 336–345. **Mason.**
Environment in Relation to Sex in Human Culture. By Prof. Otis T. Mason.

An examination of the culture-areas of the world in regard to the status in them of men and women.

Anthropogeography. *G.Z.* 8 (1902): 92-100. **Hettner**

Die wirtschaftlichen Typen der Ansiedelungen. Von Alfred Hettner.

Ethnology. **Schurtz.**

Alterklassen und Männerbünde. Eine Darstellung der Grundformen der Gesellschaft. Von Heinrich Schurtz. Berlin: G. Reimer, 1902. Size 9 × 6, pp. x. and 458. *Map. Price 8s.*

On certain special forms of social organization among primitive peoples, especially the system of separate quarters for men, sometimes known as "communal barracks." The distribution of this system throughout the world is very fully dealt with.

Historical. *Riv. G. Italiana* 9 (1902): 3-38. **Uzielli.**

Toscanelli, Colombo e la leggenda del Pilota. Memoria del Prof. Gustavo Uzielli.

A criticism of M. Vignaud's work (cf. review, *ante*, p. 749).

Historical Geography. **Wagner.**

Vignaud, Henry. La lettre et le carte de Toscanelli sur la route des Indes, etc. (Von Hermann Wagner.) Sonder-Abdruck aus den Göttingischen Gelehrten-Anzeigen unter der Aufsicht der Königl. Gesellschaft der Wissenschaften, 1902. No. 2. Size 9½ × 6½, pp. [14]. *Presented by the Author.*

Criticism of M. Vignaud's work (cf. *ante*, p. 749).

Slavery. *Petermanns M.* 47 (1901): 285-287. **Vierkandt.**

Die Sklaverei als ein Wirtschaftssystem. Von Dr. A. Vierkandt.

BIOGRAPHY.

Cordeiro. *B.S.G. Lisboa* 18 (1900): 667-685. **Amaral and Pedroso.**

A Luciano Cordeiro, discurso do Conselheiro F. J. Ferreira do Amaral.—Luciano Cordeiro e a sua obra. Por Z. Consiglieri Pedroso.

Nubkissen. **Ghose.**

Memoirs of Maharaja Nubkissen Bahadur. By N. N. Ghose. Calcutta: K. B. Basu, 1901. Size 10 × 6½, pp. vii. and 242. *Portraits and Illustrations. Price 7s. 6d. Presented by the Author.*

Nubkissen was one of the characters who came upon the scene in the stormy days of Warren Hastings' administration. The author considers that in character and aspirations he was the very antithesis of Nuncomar, as to whom he accepts the verdict of Sir James Stephen.

Orléans. *Deutsche Rundschau G.* 24 (1901): 136-138. ——

Prinz Henri d'Orléans. *With Portrait.*

Rhodes. **Hensman.**

Cecil Rhodes. A Study of a Career. By Howard Hensman. Edinburgh: W. Blackwood & Sons, 1901. Size 9 × 6, pp. xiv. and 382. *Portraits and Illustrations. Price 12s. 6d. net. Presented by the Publishers.*

Tomaschek. *Vierteljahrshefte G. Unterricht* 1 (1902): 102-112. **Sieger.**

Wilhelm Tomaschek. Von Dr. R. Sieger. *With Portrait.*

GENERAL.

British Association. ——

Report of the Seventy-first Meeting of the British Association for the Advancement of Science, held at Glasgow, in September, 1901. London: John Murray, 1901. Size 9 × 5½, pp. cxx., 900, and 114. *Diagrams. Presented by the British Association.*

Colonies. **Austin**

Colonial Administration, 1800-1900. Methods of Government and Development adopted by the principal Colonizing Nations in their control of Tropical and other Colonies and Dependencies. With statistical statements of the Area, Population, Commerce, Revenue, etc., of each of the World's Colonies. Including Bibliography of Colonies and Colonization prepared by the Library of Congress. (From the Summary of Commerce and Finance for October, 1901.) O. P. Austin, Chief of Bureau (Treasury Department—Bureau of Statistics). Washington, 1901. Size 11½ × 9½, pp. 1199-1631. *Maps. Presented by the Philadelphia Commercial Museums.*

Colonies. **Zimmermann.**

Le Problème Colonial au début du XX^e siècle. Leçon d'ouverture faite à la Faculté des Lettres le 5 décembre, 1901. Par M. Maurice Zimmermann. Lyon: A. Storck & Cie., 1902. Size 10 × 6½, pp. 24.

Discusses the tasks to be performed and some of the difficulties to be overcome in European Colonial undertakings.

Eastern Lands. **Hogarth.**

The Nearer East. By D. G. Hogarth. London: W. Heinemann, 1902. Size 9½ × 6, pp. xvi. and 296. *Maps and Diagrams. Price 7s. 6d. Presented by the Publishers.*

This will be reviewed in an early number of the *Journal.*

Education. **Kirchhoff.**

Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 111–115.

Die Verknüpfung der physischen mit der politischen Landeskunde im Schulunterricht. Von Prof. Dr. A. Kirchhoff.

Education. **Langenbeck.**

Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 116–123.

Die Verknüpfung der physischen mit der politischen Landeskunde in Schulunterricht. Von Prof. Dr. Langenbeck.

Education. **Wagner.**

Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 60–74.

Die Organisation des geographischen Unterrichts nach den neuen Lehrplänen. Von Prof. Dr. Hermann Wagner.

Educational. *National G. Mag.* **13** (1902): 55-64. **Tarr.**

The Teaching of Geography. By Ralph S. Tarr.

Engineering Congress. ——

International Engineering Congress. Glasgow, 1901. Meeting held at the University, Glasgow, on the 3rd, 4th, and 5th September, 1901. 2 vols. Vol. I. Proceedings of Section I.—Railways. Vol. II. Proceedings of Section II.—Waterways and Maritime Works. London: W. Clowes & Sons, 1902. Size 10 × 6½, pp. (vol. i. 84) (vol. ii. viii. and 214). *Maps, Diagrams, and Illustrations. Price,* vol. i. 5*s.* 6*d.*, vol. ii. 6*s.* 6*d. Presented by the Executive Committee of the Congress.*

Exploration. *B.S.G. Lyon* **17** (1902): 511-544. **Groffier.**

Explorations et Travaux Géographiques des Missionnaires Catholiques en 1900. Par M. Valérien Groffier.

French Colonies. **Dubois and Terrier.**

Les Colonies Françaises. Un Siècle d'expansion Coloniale. Par Marcel Dubois et Auguste Terrier. (Exposition Universelle de 1900.) Paris: A. Challamel, 1902. Size 9 × 6, pp. 1072.

This ranks as vol. i. of the series of publications issued in connection with the International Exhibition of 1900, other volumes of which were noticed in the *Journal* a year ago. It is written in a scholarly way, taking account of the broad principles which have operated in the course of French colonial history, of which it supplies perhaps the clearest general outline that has yet appeared.

German Colonies. ——

Jahresbericht über die Entwickelung der deutschen Schutzgebiete in Afrika und der Sudsee im Jahre 1900-1901. Mit einem Baude Anlagen. (Beilage zum Deutschen Kolonialblatt, 1902.) Berlin: E. S. Mittler, 1902. Size 12 × 9, pp. 112, 352.

Hindustani Language. **Thimm.**

Hindūstānī Self-taught with English Phonetic Pronunciation. Containing Vocabularies—Idiomatic Phrases and Dialogues—Travel Talk—Military, Legal, Religious, Commercial, Shooting, and Fishing Terms—Money, Weights and Measures—Indian Titles, Castes, Festivals. By C. A. Thimm. London: E. Marlborough & Co., 1902. Size 7 × 4½, pp. 112. *Price 2s. 6d. Presented by the Publishers.*

Although no doubt of much use for self-tuition in Hindustani, this little work is incomplete for that purpose without the companion volume, "Hindustani grammar self-taught" being in the main a collection of vocabularies and phrases. The phonetic

system is not always satisfactory: thus *u* is used both for the indefinite *a* sound in *amount* (for which it seems particularly unsuitable when occurring at the end of a word), and for the *u* sound in *pull*; while *i* serves both for the diphthong *ai* and for the short *i*, as in *fit*. The occasional use of paraphrases without a statement of the literal meaning is also a defect.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

British Isles. **Ordnance Survey.**

Ordnance Survey revised map on the scale of 4 miles to an inch. England and Wales. Sheets 1, 2, 3, and 4. *Price* 1*s.* 6*d. each sheet.* Scotland. Sheets 1, 2, 3, 4, 5, and 6. *Price* 1*s. each sheet.* Ordnance Survey Office, Southampton. *Presented by the Director-General, Ordnance Survey.*

These maps serve well to exemplify the very successful attempts that have been made during recent years to render the sheets of the Ordnance Survey of more general and popular service, and to print them in colours by which due prominence can be given to the physical features, roads, etc., without obscuring the lettering. The Director-General may be congratulated upon the results he has obtained, after the painstaking attention he has given to the matter, and these two maps of England and Wales and Scotland, on the scale of 4 miles to an inch, will no doubt meet with a ready welcome. They are similar in style of production and are reduced from the revised 1-inch maps. Five colours are employed—water blue, hills brown, woods green, main roads burnt sienna, and outline and lettering black, which combination gives a very clear and artistic result. The hill shading is shown in a manner which has not before been attempted by the Ordnance Survey—in stipple by photo-etching. No contour lines are given, but numerous altitudes are indicated in figures. One good feature of the maps, which will certainly be appreciated by cyclists, is the manner in which the roads are distinguished. First-class roads are shown by a double line and coloured, second-class roads by a double line uncoloured, and third-class roads by a single black line. There is a footnote stating that the representation of a road upon the maps is no evidence of the existence of a right of way. The map of England and Wales will consist altogether of twenty-four sheets, of which Nos. 1, 2, 3, and 4, including Northumberland, Durham, Cumberland, the northern parts of Westmoreland, Yorkshire, and the Isle of Man, are now published, whilst the map of Scotland will comprise seventeen sheets, of which Nos. 1 to 6 are on sale. These include the Shetland and Orkney Islands, Sutherland, Caithness, the northern part of Rosshire, the island of Lewis, and neighbouring islands.

A black and white 4-miles-to-the-inch map of England and Wales has already been completed, and a similar map of Scotland is in course of preparation, but these are without hill-work. The 4-miles-to-the-inch scale was first decided upon for military purposes, but it was afterwards considered that this scale would be useful for other purposes, as it admits of showing railways, important roads, and general topographical features with considerable amount of detail.

Channel Islands.

Jersey. Scale 1 : 31,680 or 2 inches to 1 stat. mile. *Price* 1*s.*

(E. Stanford, London Agent.)

England and Wales. **Ordnance Survey.**

ORDNANCE SURVEY OF ENGLAND AND WALES:—Revised sheets published by the Director-General of the Ordnance Survey, Southampton, from April 1 to 30, 1902.

1 inch:—

With hills in brown or black: 85, 168, 178, 179 (engraved). 1*s. each.*

6-inch—County Maps:—

Bedfordshire, 2 S.W., 10 N.E., 11 N.E., S.E., 24 N.W., 31 N.W. **Derbyshire**, 60 N.W., N.E., S.W. **Huntingdonshire**, 5 S.W., 16 S.W., 20 S.E., 21 N.W., N.E., 25 N.E. **Monmouthshire**, 1 S.W. (2 S.E. and 4 N.E.), 3 N.E., S.W., S.E. (4 N.E. and 2 S.E.), 5 (N.W. and S.W.), 7 N.W., S.W., S.E., 8 N.W., 11 S.W., S.E., 12 N.E., S.W., 13 N.W., S.W., 14 N.W., S.E., 19 N.E., S.E., 20 N.W., S.W., 22 N.E., 23 S.E., 24 N.W., S.W., 25 N.E., S.W., 27 N.E., 29 N.W., S.E., 30 N.E., 33 S.E., 34 N.E., 40 N.W. **Staffordshire**, 47A N.W. **Wiltshire**, 63 S.W., 64 S.W., 66 S.E., 68 N.E., 74 N.E., 77 S.E. 1*s. each.*

25-inch—County Maps:—

Cambridgeshire, III. 4; IV. 5, 6, 7, 10, 11; XVI. 1, 4, 8, 12; XXI. 4, 9, 10, 11, 14; XXV. 5; XXXIII. 9, 13; XXXVIII. 3, 7, 11, 14, 15; XLV. 3, 9, 10, 11. **Dorsetshire**, VII. 1, 5, 6; XXXII. 11, 15; XLI. 3, 7; XLII. 1, 2, 5, 6, 9, 10, 13, 14, 15; XLIII. 16; XLIV. 6, 7, 10, 11, 14, 15; XLIX. 3, 4, 7, 8, 11, 12, 16; LV. 4, 7, 8, 11, 12, 16. **Gloucestershire**, V. 9, 13, 14; VII. 16; XIII. 5; XIV. 9, 10, 14; XV. 5, 9, 14; XX. 1, 3, 4, 5, 6, 7, 8, 10, 11, 12, 14, 15; XXI. 1, 5, 11, 13, 14, 16; XXII. 2, 5, 9, 10, 11, 13, 15; XXVIII. 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16; XXIX. 1, 2, 5; XXXII. 9, 10, 11, 14; XXXV. 5; XLI. 11; XLIX. 5, 6, 11, 12; LVIII. 1. **Huntingdonshire**, XXIII. 9, 13; XXVI. 3, 7, 11, 14, 15; XXVIII. 3, 9, 10, 11. **Montgomeryshire**, XVI. 15; XXII. 8, 10, 11, 12, 13, 15, 16; XXIII. 4, 6; XXIX. 2, 4; XXXIV. 15; XXXV. 5, 6, 7, 9, 10, 12; XLI. 1. **Shropshire**, XV. 13; XXIII. 12; XXIV. 9, 13; XXVIII. 13, 14, 15; XXIX. 13; XXXI. 13; XXXII. 15; XXXIII. 4; XXXV. 5, 8; XXXVI. 2. **Somerset**, LXXXV. 1, 5, 6. **Staffordshire**, XLIII. 4, 7, 8, 12, 15, 16; XLIV. 1, 2, 5, 6, 9, 10, 11, 13, 14, 15, 16; XLV. 8, 10, 12, 14, 15; XLVI. 4, 5, 13; LII. 3. **Worcestershire and Do. (Det.** 4, 5, and 6); XLVIII. 10 (Area of Bredon's Norton Parish only), 11 (Areas of Bredon and Bredon's Norton Parishes only), 14 (Areas of Bredon and Bredon's Norton Parishes only); LVI. 5; LVII. 10, 14; LVIII. 5, 9; LXI. 1; LXII. 11. **Yorkshire**, CCXCIX. 12; CCC. 1, 2, 3, 4, 5, 6, 8, 9, 11, 13, 14. 3*s. each.*

England and Wales. **Bartholomew.**

Cyclists' Road Map of the Leeds, Bradford, and York District. Reduced from the new revised Ordnance Survey. Scale 126,720 or 2 stat. miles to an inch. Edinburgh: J. Bartholomew & Co., 1902. *Price* 1*s.* 6*d.*, *mounted on cloth. Presented by the Publishers.*

Unlike most of Bartholomew's reduced Ordnance maps, no orographical colouring is employed upon the present sheet, which is to be regretted, although of course the omission considerably reduces the cost of production, and consequently the price. However, the elevations and depressions are indicated by contour-lines and figures, and roads suitable for cycling coloured brown, a distinction being made between first and second class cycling roads. This sheet extends from Ripon on the north, to Sheffield on the south, and from Altrincham on the west, to a few miles to the east of Market Weighton on the east, and thus includes, amongst other important centres, York, Harrogate, Bradford, Leeds, Manchester, Wakefield, and Gainsborough.

Tyrol. **Burgklehner.**

Mathias Burgklehners Tirolische Landtafeln 1608, 1611, 1620. Abdruck der in den Kunsthistorischen Sammlungen des Allerhöchsten Kaiserhauses in Wien aufbewahrten Holzstöcke und Kupferplatten. Herausgegeben mit Genehmigung des Oberstkammereramtes seiner Kaiserlichen und Königlichen Apostolischen Majestät. Mit einem Begleittexte von Eduard Richter. Wein: Adolf Holzhausen. *Presented by Dr. Eduard Richter.*

The author of these maps, Mathias Burgklehner, who lived from 1573 to 1642, was not a cartographer by profession, but a lawyer and an official. He wrote a history of Tyrol in twelve volumes, which remained in manuscript, for the illustration of which the map, executed A.D. 1611, was probably intended. It is uncertain whether Burgklehner constructed the map himself, or had it made for him. The blocks on which it was engraved, preserved in the Hof Museum at Vienna, have lately been reproduced by Messrs. Holzhausen in a large folio. The map of the Tyrol on twelve sheets, placed together, makes a wall map over 4 feet square. The towns, woods, villages, and mountains are drawn in rough perspective in a bold and highly picturesque style. Very few names of peaks are given, but the passes, or "Thaüren," of Central Tyrol are marked, and the name "Gloggner" may be discovered. Here and there the plate is enlivened by a representation of a battle, or some stags! It is further adorned with numerous coats-of-arms of cities, heraldic devices, and a fine Renaissance border. The surrounding countries are covered with clouds. Dr. Eduard Richter gives an interesting sketch of Burgklehner's life and work in the accompanying text.

ASIA.

Asia. **Heiderich.**

Hölzel's Schulwandkarte von Asien. II. Auflage. Vollkommen neubearbeitet von Dr. Franz Heiderich. Scale 1 : 8,000,000 or 126·2 stat. miles to an inch. Wien: Ed. Hölzel. 6 sheets. *Price* 13*s.* 6*d.*

This is the second and revised edition of a school wall map of Asia, measuring

about 4½ feet by 6¼ feet when the sheets, which are six in number, are joined as one. Heights above sea-level are shown by a combination of hachuring and six shades of colour-tinting at intervals varying from 200 to 2500 metres, whilst another shade indicates depressions. The depths of the sea are shown in the usual manner by five tints of blue, which increase in density with the depths. There is hardly sufficient difference between some of the shades of colour used to give satisfactory results, and it would have been better if, instead of employing different colours to indicate the altitudes, shades of one colour only had been selected, as is the case with Mr. Mackinder's geographical map of Europe. The hill shading beneath the colour tinting is somewhat misleading in its general effect, as it necessarily darkens some of the tints, and thus gives the impression that the altitude is greater than it really is.

Asia Minor. **Kiepert.**

Karte von Kleinasien. Scale 1 : 400,000 or 6·3 stat. miles to an inch. Von Dr. Richard Kiepert. Sheets: C IV. Kaisarie; D III. Ermenek. Berlin: Dietrich Reimer (Ernst Vohsen), 1902. *Price 6 marks each sheet.*

With the present issue there are altogether five sheets of Dr. Kiepert's new map of Asia Minor now published; these are—A IV. Sinob; B IV. Jozgad; C III. Konia; C IV. Kaisarie; and D III. Ermenek. The map when complete will comprise altogether twenty-four sheets. The two sheets just published are in every respect equal to the earlier ones, and it is evident that the author has made good use of the best available information, that obtained from Turkish and Greek sources being specially distinguished. A notice of this most important map was given in the February number of the *Geographical Journal* for this year.

Hong-Kong. **Public Works Department, Hong-Kong.**

Plan of the City of Victoria, Hong-Kong, 1901. Scale 160 feet to an inch. 10 sheets. *Presented by H.M. Secretary of State for the Colonies.*

Siberia. **Petermanns Geographische Mitteilungen.**

Sibirikows Weg von Jakutsk zum Ochotskischen Meere. Scale 1 : 7,500,000 or 118·3 stat. miles to an inch. Der Weg von Ajan nach Neljkan. Scale 1 : 2,000,000 or 31·5 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1902, Tafel 8. Gotha: Justus Perthes. *Presented by the Publisher.*

Singapore. **Van Cuylenburg.**

Map of the Island of Singapore and its Dependencies, 1898. Scale 1 : 63,360 or 1 stat. mile to an inch. Prepared and drawn by John Van Cuylenburg, Surveyor-General's Office, Singapore. *Price 16s.*

This is a useful general map of the island of Singapore, printed in colours. It shows by different symbols boundaries of districts and estates, main roads, minor roads, cart-tracks and footpaths, proposed roads, proposed railway, forest reserves, and trigonometrical stations. It also indicates the police stations, Government vernacular schools and bungalows. Altitudes are given in feet. Although useful for the information the map contains, its execution leaves much to be desired, and in many places the names and figures are very indistinct.

Tonkin. **Friquegnon.**

Tonkin et Haut Laos par le Commandant Friquegnon de l'Infanterie de Marine. Carte dressée d'après les travaux des Officiers des troupes de l'Indo-Chine, du Service Hydrographique de la Marine, des membres de la mission Pavie, du Prince H. d'Orléans et du Lieut. de Vsseau. Roux, 1902. Scale 1 : 500,000 or 7·8 stat. miles to an inch. Service Géographique des Colonies. Camile Guy, Chef de Service. Paris: Augustin Challamel. 4 sheets. *Price 12s.*

In addition to Tongking, this map includes the northern portions of Siam and Annam and parts of southern China, extending approximately from 17° 45′ to 23° 20′ N. lat., and from 100° to 108° 10′ E. long. With the exception of Tongking itself and the coast territories of Annam, the region included is very imperfectly known, and a good deal that is laid down on the map must not be relied on with any certainty. Like many of the French Government maps, it is well executed and most artistically printed in colours. There is an inset on a larger scale (1 : 300,000) of the delta of Tongking from Hanoi to the coast.

AFRICA.

Africa. **Intelligence Division, War Office.**

Africa. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Sheet: (Provisional) 78-H. Boma. London: Intelligence Division, War Office, 1902. *Price 1s. 6d.* Stanford. *Presented by the Director-General of Mobilization and Military Intelligence.*

West Africa. **Langhans.**

Langhans: Beiträge zur Kenntnis der deutschen Schutzgebiete, No. 18: Reisewege des Presbyterianer-Missionars Alexander Ross von Alt-Kalabar ins Kamerun Gebiet 1877 und 1878. Von Paul Langhans. Scale 1 : 200,000 or 3·1 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1902. Tafel 7. Gotha: Justus Perthes. *Presented by the Publisher.*

NORTH AMERICA.

Bering Strait. **Immanuel.**

Die Goldgebiete zu beiden Seiten der Beringstrasse. Von Hauptmann H. Immanuel. Karte der Tschuktschen Halbinsel. Scale 1 : 3,000,000 or 47·3 stat. miles to an inch. Karte der Seward Halbinsel. Scale 1 : 2,000,000 or 31·5 stat. miles to an inch. Die Verkehrswege nach den Klondike Goldfeldern. Scale 1 : 20,000,000 or 315·6 stat. miles to an inch. Die Goldfelder von Klondike. Scale 1: 10,000,000 or 157·8 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1902, Tafel 5. Gotha: Justus Perthes. *Presented by the Publisher.*

United States. **Rand, McNally & Co.**

Indexed County and Township Pocket Maps of Illinois; scale 1 : 950,400 or 15 stat. miles to an inch; Indian and Oklahoma Territories, scale 1 : 823,680 or 13 stat. miles to an inch; Indiana, scale 1 : 696,960 or 11 stat. miles to an inch. Chicago and New York: Rand, McNally & Co., 1902. *Price* $0.25 *each. Presented by the Publishers.*

These are new editions of three of Rand, McNally & Co.'s useful maps of the United States and Territories.

GENERAL.

World. **Stieler.**

Neue, neunte Lieferungs-Ausgabe von Stielers Hand-Atlas, 100 Karten in Kupferstich. V. Lieferung. Gotha: Justus Perthes. *Price* 60 *pf.*

This part contains two new maps, one (No. 62) being the northern sheet of a two-sheet map of India and Central Asia, on the scale of 1 : 7,500,000, and the other (No. 78) the north-east sheet of a four-sheet map of Australia, on the scale of 1 : 5,000,000. The earlier edition (1891) contained a map similar in area and scale to that of Central Asia (No. 62), and from a comparison of the two it will be seen at a glance how much our geography of the region has advanced during recent years. It is to be regretted that this map has been drawn just too soon to include the results of the surveys of Captain Kozloff's expedition, which have now been published. This is a good, useful map for general reference, but the representation of the relief is not altogether satisfactory owing in great measure to the dark tint that has been superimposed upon the brown hachuring. No. 78 contains the whole of Queensland north of Rockhampton, part of British New Guinea, and the eastern portion of the northern territory of South Australia. It is well drawn and clearly printed.

CHARTS.

Cape Verd Islands. **Commissão de Cartographia, Lisbon.**

Oceano Atlantico Norte. Archipelago de Cabo Verde. Scale 1 : 500,000 or 7·8 stat. miles to an inch. 1900. Commissão de Cartographia, Lisbon.

North Atlantic Ocean and Mediterranean Sea. **Meteorological Office, London.**

Monthly Pilot Chart of the North Atlantic Ocean and Mediterranean Sea for May, 1902. Meteorological Office, London. *Price 6d. Presented by the Meteorological Office.*

United States Charts. **United States Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for April and May, 1902. U.S. Hydrographic Office, Washington, D.C. Uniform Systems of Buoyage as adopted by various Maritime Nations. By Lieut. T. A. Kearney, U.S. Navy. U.S. Hydrographic Office, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Euphrates River. **Huntington, Knapp & Ward.**

Thirty-five photographs of the gorges of the Euphrates and neighbourhood, taken by Messrs. Ellsworth Huntington, G. H. Huntington, G. P. Knapp, and P. T. B. Ward. *Presented by Ellsworth Huntington, Esq.*

These photographs were taken last year during the expedition of Mr. Ellsworth Huntington, of which an account will shortly be given in the *Geographical Journal*. They are small in size, but, generally speaking, well taken and clear. The following is a list of the titles :—

(1) Bridge over the Euphrates at Palu; (2) Crater south of Lake Gyuljuk, looking south-west towards Hazar Baba mountains; Lake Gyuljuk, with Hazar Baba mountains in the distance; (4) An Armenian sheep-dealer, our head servant who took the horses from Akhor to Gerger; (5) Kellek in process of construction; (6) Island Castle, looking up-stream: Rock-hewn stairs and platforms are evident on the middle and left side of the island; (7) Looking up-stream from the Island Castle; (8) Ruined bridge over the Muzur Su, near Mazgerd; (9) Hot springs on the banks of the Peri Su at Baghin; (10) Haldi castle near the Peri Su at Baghin: a typical Turkish scene; (11) Kellek on the Murad Su near Ashvan; (12) Valley of the Kara Su at Egin; (13) Looking up the Kara Su 15 miles below Egin; (14) Making a portage around the rapid 15 miles below Egin; (15) Looking up-stream at the rapid in the Kara Su 15 miles below Egin; (16) Kellek on the Kara Su: one of the two Turkish kellekjis holds up his spoon-shaped walnut paddle; (17) Looking down the Euphrates from the old marble quarry near Geban Maden; (18) Ferry-boat at Maden; (19) Looking up the Euphrates below Geban Maden; (20) In the cañon below Geban Maden; (21) Mouth of a tributary cañon an hour below Geban Maden; (22) Tupli Rock in the gorge an hour below Geban Maden; (23) Fault in the gorge below Geban Maden; (24) Escort of Kizilbash Zaptiehs in Dersim beside a branch of the Muzur Su; (25) Kizilbash Kurd crossing the Euphrates on an inflated sheepskin; (26) Kurdish tent on Sarichichek mountain, near Egin; (27) Entrance to the great cañon at Kemur Khan, looking south; (28) Looking up the Euphrates from a camp at the beginning of the Kemur Khan gorge below the first portage; (29) Looking down the Euphrates at Tilek: Hot spring at left; (30) Cañon of the Euphrates river cut through a small ridge between Chunkush and Gerger; (31) Zaza Kurds on the ruins of an old Syrian church on the right bank of the Euphrates at Helim, near Gerger; (32) Group of Zaza Kurds, women and children, at Helim; (33) Looking up-stream in the cañon of the Euphrates at Morfa, just south of the Gerger ridge; (34) Gerger castle from the south-west; (35) An Armenian family at Gerger.

North America. **Marsden.**

Twelve photographs of Alaska, and Herschel Island near the mouth of the Mackenzie River. Taken by Maurice Marsden, Esq. *Presented by Maurice Marsden, Esq.*

As few photographs have been taken of this region, these form a welcome addition to the Society's collection, although some of them are not very good specimens :—

(1) Whaling station on Herschel island, mouth of Mackenzie river; (2) Whaling fleet at Herschel island; (3) Esquimaux children, Herschel island; (4) Itgillik and child, natives of the district near Herschel island; (5) The *Orca*, largest whaler of the Arctic fleet, north of Point Barrow; (6) On an iceberg in a snowstorm north of Point Barrow; (7) Steam whalers off the north coast of Alaska; (8) *Karluq*, steam whaler, north of Point Barrow; (9) Return Reef, furthest westerly point reached by Sir John Franklin; (10) *Jeannette*, steam whaler, near Blossom shoals: the ship in the background is badly pinched; (11) Steam whaler; (12) Dutch harbour, Unalaska.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

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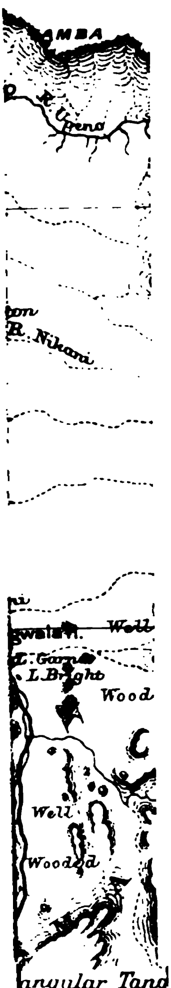

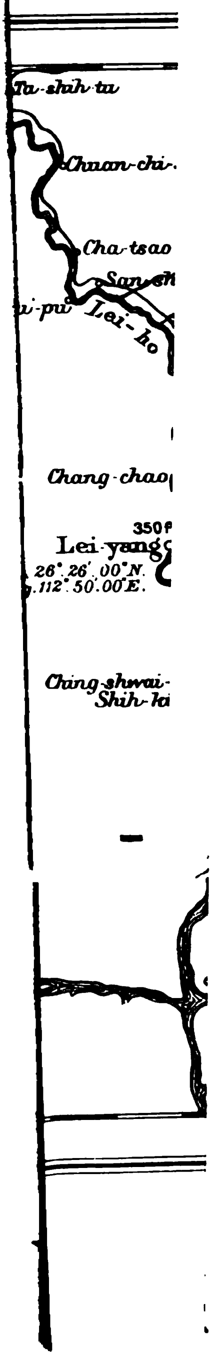
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